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Volume 4, Number 4, February 28, 1979

ENERGY RESEARCH ABSTRACTS

COAL AND COAL PRODUCTS

PROCESSING

7183 (FE—2449-6) **Studies in support of recirculating bed reactors for the processing of coal. Semi-annual report, September 1, 1977—March 30, 1978.** Gajdos, L.J.; Bierl, T.W.; McIver, A.E.; McGovern, J.J.; Farthing, G.A. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). May 1978. Contract EX-76-C-01-2449. 63p. Dep. NTIS, PC A04/MF A01.

In conjunction with Coal Mixer Modelling Studies, the behavior within the upflowing portion of the recirculating bed reactor (RBR) experimental model has been identified as typical of that known to exist in the large scale risers prevalent in petroleum processing. That is, the solids transport occurs in a high velocity, low density core, which is surrounded by an annulus of recirculating solids. Also, the density of solids in the RBR decreases with height and approaches an asymptotic value near the riser exit. A preliminary mixing experiment was performed to verify the integrated operation of the apparatus. Preliminary results using x rays to obtain "pictures" inside the riser were very encouraging. In Coal Hydrodesulfurization Studies, the reactor design has been changed from a tubular coil to a riser reactor. Results of tests with the alumina feeder and entrained transport system have been disappointing—stable flow of the material has yet to be attained. Preliminary coal feeder tests indicate the feedrate of coal is constant in time to within an error of 0.8 percent. Equilibrium studies attempting to sulfide char, have produced less than 1 percent (wt.) sulfur concentration in the char with surface areas from 100 m^2/g to 1473 m^2/g.

CARBONIZATION

7184 **New Prosper experimental coking plant.** Habermehl, D.; Frenzel, H.; Rohde, W.; Beck, K.G. *Glueckauf;* **114**: No. 15, 643-647(Aug 1978). (In German).

The instrumentation available in the demonstration coking plant is excellently suited to the analysis of the horizontal chamber coking process on an industrial scale and to the testing of further developments. The investigations on the use of magnesite as refractory material for the building of the coking oven have remarkably shown how important it is to operate a pilot plant on a large technical scale before technical realization on an industrial scale. Innovations are thus considerably simplified, and the risk is greatly reduced.

7185 **Advance calculation of the coking time by transformation of temperature.** Worberg, R.; Szurman, E.; Eisenhut, E. *Glueckauf-Forschungsh.;* **39**: No. 2, 57-62(Apr 1978). (In German).

A characteristic function for the average orifice temperature operation time is concluded from the experimentally determined temperature-time relationship in chamber coking. The values of the remaining influencing parameters are summarized in the term complex constancy and the passing to different complex constancies is interpreted as linear temperature transformation. The characteristic exponential function describes the dependence of the operation time on its significant influencing parameters accurately enough for practical purposes. Nomograms are proposed enabling problems in operational practice to be solved by simple means. Finally, the influence of the chamber width on the operation time is comparatively considered.

7186 **Note on testing possibilities afforded by the Marienau experimental station in the field of coking.** Prudhon, G. Paris; Association Tech. Siderurgie (1977). 9p. (In French).

This paper presents an account of the station and its work on an experimental battery of coke ovens including the control of side wall temperatures. The prospects of manufacturing coke from coal barely suitable for this purpose is discussed.

7187 **Fluid-bed carbonization/desulfurization of Illinois coal by the clean coke process: PDU studies.** Boodman, N.S.; Johnson, T.F.; Krupinski, K.C. (U. S. Steel Corp., Monroeville, PA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 28-44(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Results obtained in operation of a coal carbonization process-development unit (PDU) are presented. The carbonization PDU of the CLEAN COKE Process has proved to be a valuable research tool in demonstrating, on a substantial scale, the efficient desulfurization of Illinois coal in a continuous, pressurized, fluid-bed carbonizer. After conventional cleaning and sizing, coal was processed during sustained operation of up to 10 days through two separate stages of carbonization, which together removed more than 90 percent of the coal sulfur and produced char containing as little as 0.2 percent sulfur. First-stage carbonization at a temperature of about 820°F served primarily to produce a nonagglomerating semi-char feed for high-temperature carbonization, but the first-stage carbonization removed about one third of the sulfur from the coal and produced about two-thirds of the total tar. Second-stage carbonization removed up to 90 percent of the remaining sulfur and produced low-sulfur char, hydrogen-rich fuel gas, and tar. Both forms of sulfur, organic and inorganic, were shown to be removed with equal facility by the carbonization process. In addition to the data on desulfurization and process yields and chemistry, the PDU has provided much useful engineering information, which was needed for the design of a 100-ton-per-day pilot plant. The pilot-plant process-design work is currently in progress, and continued testing in the PDU will generate data needed for the design. Concurrently, studies are in progress on carbonization of high-sulfur coals from other major seams of national interest. Coal from the Kentucky No. 9 seam is being processed at present, and this will be followed by testing of a Pittsburgh seam coal.

7188 **Carbonization/hydrogenation method for producing metallurgical coke.** Schowalter, K.A.; Boodman, N.S. (United States Steel Corp., Monroeville, PA). pp 1.249-1.254 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Development of the Clean Coke Process is reviewed. Information is included on coal preparation and carbonization, coal hydrogenation, and coke preparation. (JRD)

7189 **High-temperature fluidized-bed carbonization of coal.** Thuy, M.V. Kensington, Australia; Univ. of New South Wales (1976). vp.

Thesis.

Wallarah coal was successfully carbonized in a lean-phase fluidized bed reactor immersed in a fluidized sand bed at 650°-960°C with steam as carrier gas and 123-530 μm coal particle size. The rates of devolatilization and the product distribution depended on the reactor length and the bed temperature. Cracking of volatile products to hydrogen and carbon and the water gas shift became important above 850° and 900°C, respectively. Based on pressure response measurements of the solid particle velocity, empirical dimensionless equations were derived for the pressure gradient and particle velocity in the coil, for heat transfer from tube wall to suspension, and for heat transfer from flowing gas to particles.

7190 **Production control and organization of coking plants.** Splichal, B. *Hutn. Listy;* **31**: No. 1, 4-6(1976). (In Czech).

Topics discussed include: the projected computer-based automatic control system for the new OKR coke oven plant; coke oven developmens in other countries; and costs and economics.

DESULFURIZATION AND PURIFICATION

REFER ALSO TO CITATION(S) 7187, 7239, 7241

7191 (FE—2762-3) **Formation and control of fuel-nitrogen pollutants in catalytic combustion of coal-derived gases. Quarterly report, December 15, 1977—March 15, 1978.** Bracco, F.V.; Bruno, C.; Kim, B.S.; Santavicca, P.A.; Semler, J.; Walsh, P.M. (Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences). 15 Mar 1978. Contract EF-77-S-01-2762. 13p. Dep. NTIS, PC A02/MF A01.

The review of data on NH_3 and HCN concentrations in the low/medium-Btu off-gases from the Mond, Riley-Morgan, Lurgi, Koppers-Totzek, Hygas and Synthane coal gasifiers indicates that NH_3 is present at concentrations of 385-11,000 ppmV and HCN at concentrations up to 300 ppmV. There is a tendency for NH_3 concentration to increase as the heating value of the low/medium-Btu gas increases. The observed NH_3 concentrations are consistently greater than calculated equilibrium values even when the lowest possible gasifier temperatures (at the outlet) are assumed. The fraction of coal-bound nitrogen converted to NH_3 + HCN is 12 to 91 percent. A rough estimate of the amount of NH_3 + HCN in raw low/medium-Btu gases can be obtained by subtracting the nitrogen in gasifier byproducts (ash, char and tar) from the amount of coal-bound nitrogen and assuming complete conversion of the difference to NH_3 + HCN. The reported concentrations of NH_3 and HCN in purified low/medium-Btu gases indicate that levels of 1 to 10 ppmV NH_3 and 1 to 100 ppmV HCN can be reached in low temperature cleanup at the expense of sensible heat.

7192 (PNL—2040-10) **Process of cleaning and removal of sulfur compounds from low Btu gases. Quarterly summary report, April—June 1978.** Moore, R.H.; Ham, D.G.; Mitchell, D.H.; Robertus, R.J.; Stegen, G.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1978. Contract EY-76-C-06-1830. 20p. Dep. NTIS, PC A02/MF A01.

Runs C-8 to C-12 in the process development unit are reported. Various problems related to plugging and overflow of salt are detailed; trace heater failures are also noted. Little or no corrosion of the ionized surfaces has occurred. Otherwise, data so far generated by PDU operation are completely in accordance with prediction from theory and earlier laboratory and PDU operations. (LTN)

7193 **Method of regenerating used contaminant-removing material.** Styring, R.E. (to Atlantic Richfield Co.). US Patent 4,083,924. 11 Apr 1978. Filed date 23 Jan 1974. 10p.

A method is described for regenerating used particulate contaminant-removing material, such as iron oxide or iron sulfide, that has been used to remove a contaminant, such as arsenic, from a synthetic hydrocarbonaceous feed and effect deposition of the contaminant within the material. The process is characterized by a multi-step process as follows: (1) the used, or spent, contaminant-removing material is intimately contacted with a sulfur-containing material, such as hydrogen sulfide or sulfur, in an inert atmosphere of non-oxidizing fluid and at elevated temperature; (2) the contaminant deposited in the contaminant-removing material is reacted with the sulfur in the sulfur-containing material at the elevated temperature and the resulting sulfides of the contaminant, for example, arsenic sulfides, are converted to gaseous form to separate them from the regenerated contaminant-removing material; and (3) the sulfides of the contaminant are condensed and oxidized to form the oxides of the contaminant; for example, arsenic oxides. The oxides are, ordinarily, commercially desirable products that can be sold. Also disclosed are respective embodiments and the specific reaction conditions for carrying out the invention.

7194 **Symposium of desulfurization of coal and coal char.** Ann Arbor, MI; University Microfilms International (1977). 257p. (CONF-770301—P4). $7.00.

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Papers were presented at the symposium desulfurization of coal and char, synthesis of hydrocarbons, and on liquefaction and gasification of coal. A separate abstract was prepared for each paper. (JRD)

7195 **Desulfurization and sulfidation of coal and coal char.** Kor, G.J.W. (U. S. Steel Corp., Monroeville, PA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 1-13(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Desulfurization of Illinois No. 6 coal and its char was studied. It was found that the desulfurization of coal char in mixtures of H_2 and CH_4 takes place in two distinct stages. In the first stage rapid desulfurization is accompanied by gasification. These two processes were shown to be interrelated, the relationship being dependent on the char preparation temperature only. The second stage of desulfurization was found to proceed at a much slower rate and is being controlled by the slow reduction of pyrrhotite to iron.

7196 **Hydrodesulfurization of coals.** Fleming, D.K.; Smith, R.D.; Aquino, M.R.Y. (Inst. of Gas Tech., Chicago). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 45-49(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Activities in a program to determine the operating parameters of the IGT Flash Desulfurization Process are reported. Laboratory- and bench-scale data indicate that acceptable hydrodesulfurization of coals can be achieved with the IGT Flash Desulfurization Process. Pretreatment of the coal enhances the removal of sulfur to produce a solid fuel that can be burned in conformance with the present Federal EPA limits of 1.2 lb $SO_2/10^6$ Btu. Work is progressing to prove the concept on larger, continuous, PDU-sized equipment. The complete flow sheet for the process has not yet been defined, so economic factors are at present unknown.

7197 **Desulfurization of coal in a fluidized bed reactor.** Haldipur, G.B.; Wheelock, T.D. (Iowa State Univ., Ames). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 50-61(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Activities are reported in a program to determine the feasibility of desulfurizing a high sulfur bituminous coal from an Iowa mine by treatment at moderately elevated temperatures in a fluidized bed reactor with either oxidizing, neutral, or reducing gases. Results show that it is possible to remove substantial amounts of sulfur from pulverized bituminous coal in a fluidized bed reactor operated at elevated temperatures. However, for the type of coal used in this study the removal of sulfur is accompanied by a substantial loss of volatile matter. Both the degree of desulfurization and extent of devolatilization are strongly influenced by temperature. The composition of the fluidizing gas appears to have more effect on the removal of pyritic sulfur than on the removal of organic sulfur and volatile matter in the 240 to 400°C range of temperature. Thus an oxygen bearing gas appears more effective for removing pyritic sulfur than a hydrogen bearing gas and nitrogen is completely ineffective. On the other hand, the removal of organic sulfur appears due mainly to pyrolysis and devolatilization and is not a strong function of the treatment gas composition. Since a significant part of the coal is volatilized, the recovery and utilization of the volatile products is important. While the methods applied in this study did not reduce the sulfur content of the selected coal to the point where the product would meet present air pollution control standards, further improvement in methodology is possible. From the published results of other workers, it is likely that either reducing the particle size or increasing the temperature would be beneficial, although increasing the temperature would remove more volatile matter as well as more sulfur. Also coals which initially contain less sulfur or are of a higher rank than the one selected could possibly benefit more from this type of treatment.

7198 **Chemical comminution: a process for liberating the mineral matter from coal.** Howard, P.H.; Datta, R.S. (Syracuse Research Corp., NY). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 62-72(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

The effects of different reaction conditions on chemical comminution of coal were studied. Effective chemicals were investigated along with effects of reaction conditions, effects of coal type, and chemical reactions. Results show that considerably more information is necessary before the mechanism of chemical comminution is understood. Studies directed at a better understanding of the phenomena and the effect it has on the chemically treated coal are presently underway.

7199 **Applicability of the Meyers process for desulfurization of U.S. coal (a survey of 35 coals).** Hamersma, J.W.; Kraft, M.L.; Meyers, R.A. (TRW Systems and Energy, Redondo Beach, CA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 73-83(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

The Meyers Process is a new chemical leaching process which will allow many coal-fired power plants and industrial sources to meet Federal and State sulfur oxide emission standards without the use of flue gas cleaning. This process utilizes a regenerable aqueous ferric sulfate leaching unit to chemically convert and remove the pyritic sulfur content of the coal as elemental sulfur and iron sulfate. Although only pyritic sulfur is removed (organic sulfur remains), the Meyers Process has wide applicability for converting

U.S. coal reserves to a sulfur level consistent with present and proposed governmental sulfur oxide emission standards. Thirty-five mines from the major coal basins were investigated in this study. Because of the relatively high pyritic sulfur and low organic sulfur contents, and high production (70 percent of current U.S. output) of Appalachian coals, the Meyers Process appears to have major impact in this area. Data and information are included on sulfur removal and trace element removal. (JRD)

7200 Sulfur removal from coals: ammonia/oxygen system. Sareen, S.S. (Kennecott Copper Corp., Lexington, MA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 93-99(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

A system is described which can be used to remove nearly all of the pyritic sulfur and up to 25% of the organic sulfur from coal in about 2 h. Experimental results show that increasing reaction time and ammonia concentration improved the extent of organic sulfur removal. For example, after 2 hours when using a 5 M NH_3 solution, 25% of the organic sulfur can be removed. Changing the NH_3 concentration had no apparent affect on pyritic sulfur removal. The oxygen consumption to oxidize the coal carbon (reporting as CO_2 in the gas phase and carbonae in solution) is fairly insensitive of the NH_3 concentration. Ammonia concentration has no apparent affect on oxygen uptake by the coal. Both the ammonia concentration and reaction time have an affect on the Btu and carbon values of coal. Increasing either one decreases the Btu and carbon value. As much as a 13% Btu and 10% carbon loss may be realized with using a 3 M NH_3 solution and reacting the coal for 2 hours. The large carbon losses are due to the formation of coal acids.

7201 Magnetic desulfurization of some Illinois basin coals. Murray, H.H. (Indiana Univ., Bloomington). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 106-112(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

The technology of magnetic desulfurization of coal is reviewed. It is concluded that high energy magnetic filtration (HEMF) is proven commercial process. Fine pulverization to liberate the pyrite is necessary before magnetic filtration. Sixty-five to ninety percent of the inorganic sulfur can be removed from the coal by HEMF processing a coal slurry. The estimated cost per ton is lower than using a jig circuit or heavy media circuit. The coal product from the HEMF process will be relatively clean both from sulfur and ash content.

7202 Desulfurization of coals by high-intensity high-gradient magnetic separation: conceptual process design and cost estimation. Lin, C.J.; Liu, Y.A. (Auburn Univ., AL). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 113-131(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Data are presented from pilot-scale studies of S and ash removal both wet and liquefied coals by high gradient magnetic separation (HGMS). These data are used in the design of conceptual processes for magnetic desulfuriation of coals. Estimates of magnetic desulfurization characteristics and conceptual process requirements, as well as installation and procesing costs are determined. The results indicate that the magnetic desulfurization appears to be attractive when compared with other approaches for the desulfurization, in terms of costs and performance. (JRD)

7203 Dry Table: pyrite removal from coal. Wilson, D.C. (FMC Corp., Santa Clara, CA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 132-137(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Equipment designed as a separator for dry particulates is described. It is noted that the Dry Table can reduce the sulfur content in a coal through pyrite removal. The extent of the coal-pyrite separation is a function of pyrite liberation and the physical property differences between the free flowing coal and pyrite particles. However, there are cases where even coal containing unliberated pyrite can be separated into coal products of low and high pyritic sulfur contents. The Dry Table is best employed as a rougher, it has a separation performance similar to that of a Baum Jig. It can be used alone or in conjunction with existing coal cleaning equipment. And it is especially applicable where the use of water is restricted due to limited supply, freezing, or costly treatment prior to discharge or reuse.

HYDROGENATION

GASIFICATION

REFER ALSO TO CITATION(S) 7192, 7263, 7271, 7273, 7560, 7624

7204 (CONF-771175—, pp 3.3.1-3.3.12) **Production of motor fuels by coal gasification.** van Heek, K.H. (Bergbau-Forschung GmbH, Essen). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Present techniques of coal gasification and fuel production from the resulting coal gas are reviewed. New developments currently under study and development are summarized, and the potential of coal gasification is evaluated. It is concluded that coal gasification can contribute economically to fuel production only if waste heat from nuclear reactors is used for water vapor gasification and coupled with methanol synthesis. (JSR)

7205 (CONF-780849—1) **Instrumentation development for in-stream measurements of particulate solids in advanced coal utilization.** Herzenberg, C.L.; O'Fallon, N.M.; LeSage, L.G.; Raptis, A.C.; Managan, W.W.; Doering, R.W.; Cohn, C.E.; Yarlagadda, B.S.; Cox, S.A. (Argonne National Lab., IL (USA)). 1978. Contract W-31-109-ENG-38. 32p. Dep. NTIS, PC A03/MF A01.

From Symposium on in-stream measurements of particulate solid properties; Bergen, Norway (22 Aug 1978).

Process control instrumentation for large-scale coal gasification, liquefaction, and fluidized-bed combustion systems is being developed at Argonne National Laboratory. Initial focus is on instrumentation to measure mass-flow rates and provide continuous in-stream analysis of particulate solids in solids/fluids streams. These instruments and a solids/gas flow test facility used in development and testing of mass-flow instruments at Argonne are described.

7206 (FE—2340-5) **Improved techniques for gasifying coal. Fifth quarterly report, July 1—September 30, 1977.** Graff, R.A.; Yerushalmi, J. (City Coll., New York (USA)). Jan 1978. Contract EX-76-S-01-2340. 31p. Dep. NTIS, PC A03/MF A01.

Fluidization experiments were conducted with FCC and sand in the modified 6-inch system. The experiments with FCC show that at a given gas velocity and for the same driving force, solid rates and fluidized densities in the modified fast bed were comparable to those recorded in the earlier arrangement which utilized the U-tube to transfer solids from the slow to the fast bed. The efficiency of the primary cyclone was measured during experiments with FCC in the modified 6-inch system incorporating a modified cyclone. Efficiencies beyond 99.5% were achieved at high solid rates. Experiments were conducted with several solids in the two-dimensional bed to characterize the behavior of a bed of solid as the velocity across it is gradually increased. Results are given for HFZ-20. The transition from bubbling to the so-called turbulent regime was observed to occur gradually rather than sharply. Flash hydrogenation of short residence time solvent refined coal was conducted on samples provided by Mobil Research and Development Corp. The product distributions show that SRC slightly richer for flash hydrogenation than raw coal. The strong similarity to raw coal is, however, the most striking aspect of the data. Techniques for analysis of light oils were improved by a liquid nitrogen cooled U-tube added downstream of the reactor to trap and collect liquid samples. A new column was tested in the gas chromatograph for the analysis of these liquids. Tests to detect cracking of methane in the main flow control valve of the steam reactor system show that it is not a matter for concern.

7207 (FE—2621-4) **Development and evaluation of high chromium weld deposited overlays to protect less alloyed substrates from corrosion in a coal gasification atmosphere. Technical status report, June 1—July 31, 1978.** (International Nickel Co., Inc., Suffern, NY (USA)). 1978. Contract EF-77-C-01-2621. 14p. Dep. NTIS, PC A02/MF A01.

Work devoted to welding and inspection of weldments of 304L and 310 stainless steels and Incoloy 800 H using R139 (31 Cr, 3.5 Al, 15 Fe, bal. Ni) filler metal is reported. All welds made during the report period were defect free except one submerged-arc weldment of R139 deposited on Incoloy 800 H. Results of testing as welded samples are tabulated including bend tests, stress rupture, dilution of filler metals by base metals, and elemental distribution. (JRD)

7208 (FE—2729-2) **Alloy catalysts with monolith supports for methanation of coal-derived gases. Quarterly technical progress report, December 21, 1977—March 20, 1978.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 5 Apr 1978. Contract EF-77-S-01-2729. 28p. Dep. NTIS, PC A03/MF A01.

Several pelleted and monolithic nickel and nickel-cobalt catalysts were prepared and characterized by hydrogen adsorption. Differential reactor tests of powdered Ni—Co and Ni—Pd catalysts

were carried out; the results show reasonably good agreement with results determined previously for pelleted catalysts. Electron micrographs were obtained for 20 percent Ni—MoO_3/Al_2O_3, the results of which when compared with H_2 chemisorption data suggest that nickel and molybdenum oxide may form a solid solution or intermetallic complex. Regeneration with CO and air of a high loading Ni—Co catalyst poisoned in a long term in situ H_2S run was shown to recover little of the H_2 chemisorptive uptake. Construction of the "Berty" reactor system is nearing completion, and all of the major equipment for the current contract have been received. These and other significant results obtained are presented and discussed.

7209 (SAND—78-1224) **Instrumentation and process control development in situ coal gasification. Thirteenth quarterly report, December 1977—February 1978.** Northrop, D.A. (ed.). (Sandia Labs., Albuquerque, NM (USA)). Jun 1978. Contract EY-76-C-04-0789. 30p. Dep. NTIS, PC A03/MF A01.

The Hanna IV in situ coal gasification test was ignited on January 24, 1978. Sandia Laboratories is providing instrumentation support by fielding and monitoring diagnostic and remote monitoring instrumentation techniques. All techniques are supported by a minicomputer-based, field data acquisition system developed for this application which provides on-site, real-time reduction, analysis, and display of the experimental data. Reverse combustion linkage is underway and thermal analyses have defined the linkage path's location near the top of the coal seam and off the line between the process wells and its elongated shape in the vertical direction. There is also evidence for an additional path. Surface electrical data presented as potential contour plots have not been able to detect significant changes due to the linkage process. However, downhole resistivity measurements indicate changes which are consistent with the thermal data. Hardware for the microprocessor-based passive acoustic system is operational. Two new instrumentation concepts have been initiated: (1) an electrical array to be fielded in a wellbore which will allow Wenner or Schlumberger soundings at various distances away from the wellbore and (2) an inverted thermocouple string which would provide insurance against loss of data in the event of thermal override at the top of the coal seam.

7210 (TSR—78/3) **Coal pump development and technical support. Quarterly project report No. 3, 27 February—2 April 1978.** (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1978. Contract EF-77-A-01-2616. 119p. Dep. NTIS, PC A06/MF A01.

Preliminary design guidelines for pilot-plant-scale feeder developers were formulated and distributed for review. These guidelines were based upon discussions with several pilot plant process designers, pilot plant operators and A and E's involved in coal gasification along with the needs expressed by feeder developers. Areas covered include coal type, coal size, pressure, feed rate, cost, safety, life, reliability, controls, instrumentation, etc. The availability of coal feeder pilot scale test facilities still remains a problem. The apparent viscosities of Pittsburgh No. 8, Ohio No. 9 and Kentucky No. 9 coals have been measured over a range of temperatures and shear rates. The data on these measurements are included. Testing on the 1.5 in. coal pump continued with an evaluation of the performance of a compression screw with a 3 L/D metering section. Operation with this screw was smoother but very sensitive to variations in the feed rate and compression zone temperatures. Experiments using a coal extrusion reactor (similar to the original piston and die) have demonstrated a spray of coal particles (10 to 50 μm) into an atmospheric receiver. The particles were generated both with and without an impinging jet of gaseous nitrogen. Experimental results related to screw and die configuration, temperature and feed control are reported. Scaling studies to predict output rates and power requirements of larger size extruders have been initiated. Two appendices by different authors have been input separately. (LTN)

7211 (TSR—78/3, pp B1-B3) **Coal extrusion reactor, Appendix B. Progress report.** Ryason, P.R. Apr 1978.

In Coal pump development and technical support. Quarterly project report No. 3, 27 February—2 April 1978.

Several new concepts for coal reactors grew out of the original coal extrusion concept, e.g., the high shear reactor, the high intensity reactor, the high intensity gasifier and continuous coal pyrolysis. The objective of the current research is to determine experimentally the potential of these concepts for liquefying or gasifying coal more efficiently and at lower costs than in the conventional methods. To accomplish this, coal will be rendered plastic in a heated die, forced through an orifice at known shear rates by an air cylinder-actuated piston, and caused to react with reagents by suitable arrangements of injectors in the orifice plates. The initial emphasis will be on the high shear reactor, the H_2O and H_2 being injected into the sheared coal, either separately or together. Exploratory experiments on the high intensity reactor will be conducted, and if these are fruitful (based on rocket engine pressure chamber measurements), consideration will be given to water injection for the purpose of gasifying the coal. The apparatus will permit the safe exploration of methods of generating coal sprays, and some work will be conducted in this area.

7212 (UCRL—52524) **Moving equilibrium front model for in situ gasification.** Thorsness, C.B.; Sherwood, A.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Jul 1978. Contract W-7405-ENG-48. 51p. Dep. NTIS, PC A04/MF A01.

We have developed a simple model for forward-combustion in situ coal gasification. The model treats chemical and thermal problems of gasification by considering macroscopic material and energy balances written around the moving fronts associated with the process. At various points in the system, we assume thermodynamic equilibrium to exist, thus allowing the thermal and mass balances to be coupled in such a way that the performance of the system is completely specified. We have done sample calculations for a number of feed compositions using various assumptions about the thermodynamic properties of the solid-phase char and system operating pressures. The equilibrium assumptions used are most appropriate for high oxygen-feed concentrations and for coals with a mole ratio of water to carbon in the char below 0.35. The usefulness of the model is limited by two primary considerations: predicted hot gas equilibrium temperature can be so low that rate limitations in reaching equilibrium can be severe; and energy release into the wet coal may not be high enough to ensure that the predicted rate of drying will exceed the predicted rate of coal consumption.

7213 **Pressure vessel with internal thermoelements.** Peter, K. (to Otto (C.) und Co. G.m.b.H., Bochum (Germany, F.R.)). German(FRG) Patent 2,642,062/A/. 23 Mar 1978. 9p. (In German).

A pressure vessel for coal gasification is described which has a number of internal temperature measuring points where thermoelements to measure the stationary temperature profiles are arranged inside protecting tubes. The thermoelements are easily accessible also during operation.

7214 **Gasification of Iowa coal in the Synthane PDU gasifier.** Kornosky, R.M.; Gasior, S.J.; Strakey, J.P.; Haynes, W.P. (Pittsburgh Energy Research Center). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 197-205(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Overall results from an exploratory study to gasify a mildly caking, high sulfur Iowa coal in the SYNTHANE PDU gasifier have shown that carbon conversions of 80 percent and steam conversions of 16 percent can be achieved at average maximum gasifier temperatures of 1832°F and coal throughputs of 40 lb/hr ft^2. These results confirm published findings that coals having the largest amount of calcium and magnesium compounds have the lowest sintering temperatures and that the amount of sulfur in the tar and gaseous products is generally related to the amount of sulfur in the coal. The effluent water shows no significant difference from other SYNTHANE gasifier condensates, and is generally similar to coke-oven byproduct water.

7215 **Toscoal process: pyrolysis of western coals and lignites for char and oil production.** Atwood, M.T.; Schulman, B.L. (Tosco Corp., Golden, CO). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 233-252(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Toscoal pilot plant tests with coals having caking properties are reported. Results of Toscoal processing of subbituminous coal and higher rank coals are tabulated and analyzed. It is noted that Toscoal processing of coal is based on technology acquired in twenty years of continuous work on the TOSCO II oil shale retorting process. Coals of low rank can be used directly. Those of higher rank may be retorted after treatment with air and steam to effect decaking. Processing of Western coals and lignites is of interest in reducing the large freight costs currently involved in transporting moisture and non-combustible components. Use of chars rather than coal as utility boiler fuels offers investment and operating cost advantages. Chars produced may also be used in the manufacture of formcoke and as an improved feedstock in gasification. Liquid products may be used as a fuel, and as a source of chemicals, coke and pitch binders. High heating value gas is produced as a coproduct.

7216 **Lurgi process for coal gasification.** Rudolph, P.F.H. (Lurgi Mineraloeltechnik GmbH, Frankfurt am Main). pp 188-200 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The Lurgi Pressure gasification process for coal is described. Information is included on the effects of coal properties on the gasification, gas composition versus coal grade, process variables, and efficiency and economics. (JRD)

7217 **Hygas coal gasification process.** Huebler, J.; Schora, F.C. Jr.; Lee, B.S. (Inst. of Gas Tech., Chicago). pp 1.201-1.211 of

Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Details of The Hygas process are given. The chemistry of the process is presented and process operations including coal preparation, slurry feeding systems, hydrogasifier reactor, gas purification, and methanation are described. Methods of producing hydrogen for the process including the steam-oxygen system, the steam-iron system, and electrothermal hydrogen production are discussed along with process economics and water requirements. (JRD)

7218 BI-GAS process for production of high-Btu pipeline gas from coal. Grace, R.J. (Bituminous Coal Research, Inc., Monroeville, PA). pp 1.212-1.218 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Development of the Bi-Gas process is described. Details of the two-stage gasifier are given along with flowsheets for gas processing. Design and testing programs for process improvement are discussed. (JRD)

7219 CO_2 acceptor coal gasification process. Fink, C.E. (Conoco Coal Development Co., Rapid City, SD); Sudbury, J.D.; Curran, G.P. pp 1.219-1.222 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Process fundamentals including coal preparation, coal preheating, coal pressurization, gasification, gas purification, methanation and dehydration are discussed. Major advantages of the process are summarized and the effects of feedstock characteristics are analyzed. (JRD)

7220 Production of high-Btu gas by the Hydrane process. Gray, J.A. (Energy Research and Development Administration, Pittsburgh); Feldmann, H.F.; Yavorsky, P.M. pp 1.223-1.231 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The Hydrane (HYDRANE) process is a promising coal gasification process for producing high-Btu gas (900 to 1000 Btu per standard cubic foot) from any raw coal of bituminous or lower rank and is based on a two-stage hydrogasifier concept. Hydrogasification is the reaction of coal or char directly with hydrogen to produce methane. The hydrogen-coal reaction consisting of pyrolysis and hydrogasification becomes significant at about 400°C and at higher temperatures is initially very rapid. As conversion increases, the char residue becomes less reactive because of a competing polymerization reaction forming a more graphic ring structure. The status of this process is summarized including development of a bench-scale dilute-phase reactor and fluid-bed reactor. (JRD)

7221 Synthane coal gasification process. Frith, J.F.S. (Lummus Co., Bloomfield, NJ). pp 1.232-1.241 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Details of the Synthane process including coal pretreatment, coal gasification processes, and gas methanation are given. Information is included on coal handling, coal feeding, char removal, and gas purification. (JRD)

7222 In-situ coal gasification. Stephens, D.R. (Univ. of California, Livermore). pp 1.242-1.248 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

In-situ gasification of coal offers four potential advantages: (1) The product may be cheaper owing to lower capital investment, (2) environmental damage may be less, (3) the hazards to miners are avoided, and (4) it may be possible to utilize coal resources found at depths too great to be economically attractive for conventional deep-mining operations. The development of in-situ gasification is reviewed and current experiments are described. (JRD)

7223 COGAS process for conversion of coal to gas and oil products. Bloom, R. Jr.; Malakoff, H.L. (COGAS Development Co., Princeton, NJ). pp 1.261-1.268 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The COGAS Process for the conversion of coal to gas and oil products takes advantage of the high efficiency of multistage coal pyrolysis and the steam reactivity of the char from this pyrolysis. As a result, with raw oil and gas produced in a low-pressure system, the process can be economically competitive with more complex, high-pressure coal-gasification processes. Major elements of the process are described including pyrolysis, gasification-combustion, heat and power recovery, and gas processing. (JRD)

7224 Coal gasification at Sasol (Republic of South Africa). Hoogendoorn, J.C. (South African Coal, Oil, and Gas Corp. Ltd., Sasolburg). pp 1.285-1.296 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Development of coal gasification processes in South Africa is reviewed. Selection of processes is discussed along with plant start-up, process components, and variations, coal supply, and synthesis units. (JRD)

7225 Coal gasification process utilizing waste water from an external process. Matthews, C.W. (to Gulf Oil Corp.). US Patent 3,971,637. 27 Jul 1976. vp.

Gulf Oil Corp.'s coal gasification process can use polluted water obtained from other processes. A foul-water stream containing pollutants and/or dissolved salts from an external process is charged into the combustion zone where the pollutants are burned and the dissolved salts are slagged.

7226 Apparatus for gasification of coal, etc. German(FRG) Patent 2,529,802. 1976. vp.

An upstream fluidized-bed reactor and a downstream jet system reactor are described.

7227 Conversion of a town gas plant to SNG manufacture. Hannah, P.H.F.; Harvey, J.H.W. Bristol, England; Institution of Gas Engineers (1976). vp.

The report refers to the conversion of the Breakwater Works of South West Gas to S.N.G. manufacture. It reviews the reasons why Breakwater Works was chosen and the process route which was selected. The problems eencountered in the conversion and those associated with commissioning and gasmaking are examined. An attempt is also made to evaluate the cost of gas manufacture and the relative economics of the various states in terms of both money and time.

7228 In-situ Kohlevergasung (in-situ coal gasification: study on the state of the art in the United States of America). Pirklbauer, S. Vienna; Bundesminist. Wissenschaft Forschung (1976). vp. (In German).

In-situ coal gasification in the US was investigated with a view to improving utilization of Austrian coal reserves. US projects are described and evaluated and Russian systems mentioned. A detailed analysis is given of the chemical and physical reactions during underground gasification, control, measuring techniques, permeability and fracturing requirements, danger through collapse, subsidence and leakage including environmental influences, production, energy efficiency, drilling requirements and safety aspects.

LIQUEFACTION

REFER ALSO TO CITATION(S) 7205, 7264, 7271, 7273, 7589, 8414, 8416

7229 (BETC/RI—78/10) **Preparation of liquids from coals for hydrocarbon-type analysis in relation to refining.** Lanning, W.C.; Green, J.B.; Dooley, J.E. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Sep 1978. 31p. Dep. NTIS, PC A03/MF A01.

Samples of predominantly hydrocarbon liquids were prepared from coals of widely varied rank by catalytic hydrogenation. Cracking of hydrocarbon structures was minimized by the use of relatively low reaction temperatures, and the product liquids are believed to represent most of the hydrocarbons potentially obtainable from each coal. As the rank of coal decreased, reactivity of the coal increased, liquid yield decreased, less upgrading of the crude liquid was required, and hydrogen consumption increased slightly. Detailed hydrocarbon-type analysis of the liquids is in progress, and the results will be used to evaluate the potential feedstocks for production of refined fuels in relation to the type of coal used as raw material.

7230 (FE—2211-9) **Chemistry of lignite liquefaction. Quarterly report, January—March 1978.** Stenberg, V.I.; Baltisberger, R.J. Klabunde, K.J.; Woolsey, N.F.; Severson, D.; Souby, M. (North Dakota Univ., Grand Forks (USA)). Apr 1978. Contract EX-76-C-01-2211. 105p. Dep. NTIS, PC A06/MF A01.

Phenol, ethylbenzene, diphenylether, diphenylmethane, dibenzothiophene and carbazole are difficult to reduce under carbon monoxide-water conditions at 425°C in batch autoclaves. These conditions readily convert benzophenone, diphenylsulfide, thioanisole, phenylbenzyl ether, benzhydrol, quinoline, anthracene and 1,2-diphenylethane into a variety of products. For 1,2-diphenylethane, benzophenone, quinoline and benzylphenyl ether, the presence of tetralin had no effect on conversions; it had a negative effect on the conversions of thioanisole, diphenylsulfide and n-decanol; and a positive one on the anthracene reduction. Sodium carbonate aids the CO—H_2O conversions of n-decanol, benzophenone and quinoline, has no effect on the reductions of 1,2-diphenylethane and anthracene and a negative effect on the thioanisole and diphenylsulfide runs. Iron oxide aided the conversions of the benzophenone and quinoline reductions, and ferrous sulfide favored the conversion of the quinoline and the thioanisole reduction, but it had no effect on the 1,2-diphenylethane and benzylphenyl ether runs and a negative effect on the diphenylsulfide, n-decanol and anthracene ones. For all but the quinoline reaction, where hydrogen was superior, a blend of carbon monoxide-water and hydrogen was the optimum set of reducing gases. Carbon monoxide and water outperformed hydrogen for the

benzophenone and benzhydrol reductions. Three reports have been entered individually into EDB and ERA. (LTN)

7231 (FE—2211-9, pp 55-75) **Carbon monoxide—metal oxide interactions. Surface site requirements for electron transfer processes. Chemistry related to low rank coal liquefaction.** Klabunde, K.J.; Kaba, R.A.; Morris, R.M. Apr 1978.

In Chemistry of lignite liquefaction. Quarterly report, January—March 1978.

We find electron transfer from metal oxide surfaces to CO can be quite facile occurring at room temperature or below, and it is possible that this process is important as an initial CO activation step in metal oxide catalyzed reduction schemes. We have attempted to clarify what types of metal oxides interact with CO in this way, and what surface features these active metal oxides possess. More than 25 metal oxides, carbonates, hydroxides and formates were investigated: Of these, only the alkaline earth oxides MgO, CaO, SrO, and BaO and ThO_2 were electron transfer active. These oxides have in common the possession of both Lewis basic sites and one electron reducing sites (ThO_2 also possesses Lewis acid sites). On these oxides radical CO (radical anion) growth is slow. However, CO adsorption is very rapid, so we know that CO is adsorbed prior to electron transfer. Also, Lewis acids such as CO_2 poison the surface towards CO adsorption and radical formation. Thus, we believe CO is first adsorbed on Lewis base sites followed by slow migration to electron transfer reducing sites. This conclusion is supported by quantitative determination of basic site and reducing site amounts by esr, titration, and heat treatment methods. These studies are discussed, along with $C_6H_5NO_2$ (radial anion) formation on metal oxides. Our evidence indicates that CO (radical anion) and $C_6H_5NO_2$ (radical anion) are formed in high surface concentrations on the same type of reducing sites.

7232 (FE—2211-9, pp 77-84) **Highly efficient electron transfer processes over thermally activated alkaline earth oxides. Monolayer anion radical formation with nitrobenzene-MgO and high concentrations of CO radicals over MgO, CaO, SrO, BaO, and ThO_2.** Klabunde, K.J.; Kaba, R.A.; Morris, R. Apr 1978.

In Chemistry of lignite liquefaction. Quarterly report, January—March 1978.

Monolayer coverage of nitrobenzene anion radicals form at 25°C when nitrobenzene is exposed to thermally activated MgO (heat treated at 500—800°C). The ratio of surface MgO molecules: $C_6H_5NO_2$ (radical anion) is about 30 : 1. Similarly, CO radicals (perhaps CO (radical anion)) form on activated MgO, with a surface MgO: CO radical ratio of about 400—500 : 1. Of the CO molecules adsorbed at 25°, 35 percent become paramagnetic as detected by ESR methods. Other alkaline earth oxides CaO, SrO, BaO as well as ThO_2 have been found to be active in these processes. Simple crystalline defects such as metal (M^{++}) ion deficiencies at corners or steps are believed to be the electron rich sites that are responsible for these electron transfers.

7233 (FE—2211-9, pp 85-99) **Carbon monoxide—metal oxide interactions. II. Surface site requirements for the formation of paramagnetic species on thermally activated magnesium oxide.** Klabunde, K.J.; Kaba, R.A.; Morris, R.M. Apr 1978.

In Chemistry of lignite liquefaction. Quarterly report, January—March 1978.

Both carbon monoxide and nitrobenzene vapor have been exposed to well degassed, thermally activated (in vacuo) MgO surfaces; paramagnetic species are observed by epr spectroscopy in both cases. The adsorbed CO radical gave an unsymmetric g-value (g_1 = 2.00580, g_2 = 2.00480, g_3 = 2.00229). About 20—40 percent of the adsorbed CO molecules at 25° were determined to be paramagnetic with MgO heat treatment temperatures of 600 and 800°C. When nitrobenzene was adsorbed on MgO the nitrobenzene anion radical was observed. The number of radicals formed when either CO or nitrobenzene were exposed to MgO was determined as a function of the activating temperature; the data for both substrates were similar with a maximum radical concentration at a MgO heat treatment temperature of 500°C. It is concluded that similar active sites (one electron reducing sites) are important in radical formation with both substrates. However, with CO on MgO it appears that Lewis base sites may play a role as well.

7234 (FE—2537-6) **Characterization of coal-derived liquids and other fossil fuel related materials employing mass spectrometry. Quarterly report, December 30, 1977—March 29, 1978.** Scheppele, S.E. (Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry). 8 May 1978. Contract EX-76-S-01-2539. 18p. Dep. NTIS, PC A02/MF A01.

Considerable activity was devoted to resolving problems preventing the attainment of optimum performance from the mass spectrometer/data acquisition system. These activities included electronic modifications to various sections of the mass spectrometer, providing an excellent ground to the mass spectrometer, NOVA 3/12 minicomputer, and other peripheral instrumentation, and the distribution of well-regulated 120 V ac to the power supplies in the various instruments used to produce dc. The increase in the useful static resolution of the mass spectrometer from ca. 21,000 to at least 33,000 is indicative of the quality of the results obtained from these activities. In regard to development of micromolecular probe distillation in combination with field-ionization mass spectrometry for quantitative analysis, development of algorithms to permit acquisition of both probe temperatures and FI/MS data was initiated. Initial designs for the interface between the NOVA 3/12 and the comparator/microdensitometer were prepared. A manuscript describing our detailed investigation of the sensitivities for FI of saturates was prepared and accepted for publication. Progress on a report "Current State-of-the-Art in Mass Spectral Analysis of Alternate Fossil Fuels" is summarized.

7235 **Mathematical modeling of the production of liquid coal products.** Gagarin, S.G.; Dembovskaya, E.A.; Krichko, A.A.; Yulin, M.K. *Khim. Tverd. Topl.;* No. 2, 3-9(1977). (In Russian).

A general mathematical model has been worked out for the production of liquid products from coal by means of hydrogenation treatment in the presence of various amounts of petroleum products. The model's basis are regression equations which couple process indicators during hydrogenation, hydro-purification, and hydrocracking to manufacturing process parameters. The criteria for optimal production have been formulated, and optimal conditions for both the production of the maximum possible amount of boiler fuel as well as motor fuel were determined by non-linear programming methods. The relationship between optimal conditions to the amount of oil used in the process was established.

7236 **Coal liquefaction under high-mass flux and short-residence time conditions.** Oberg, C.L.; Falk, A.Y.; Hood, G.A.; Gray, J.A. (Rockwell International, Canoga Park, CA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 185-196(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Results from the testing are regarded as highly significant and encouraging. Effective methods of feeding the coal and of injection and mixing of the hydrogen and coal were developed. Significant progress was made on developing the desired reactor process and feasibility was demonstrated. For comparable flowrates, the size of this reactor is several orders of magnitude smaller than some of the other liquefaction reactors being developed. The test results indicate high overall conversion, approaching that required for a balanced plant operation. Liquid yields also appear high, although the lack of total recovery leaves some uncertainty.

7237 **Chemical bond cleavage during asphaltene formation.** Benjamin, B.M.; Raaen, V.F.; Kabalka, G.W.; Collins, C.J. (Oak Ridge National Lab., TN). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 206-207(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

An important question arising from experiments involving coal liquefaction processes is "which bonds are broken when solid coal is converted to liquids, or to soluble oils, asphaltenes, and preasphaltenes." A large variety of compounds were investigated containing structural linkages chosen, partly, from coal models suggested by Given, Weiser, and Hill, and Lyon. Some bond types appear to cleave rapidly, others with difficulty, and some not at all. These compounds are arranged in groups and their relation to coal liquefaction is considered. Examples of bonds which break easily are those attaching large groups to the aromatic nucleus of phenols and phenol ethers. Parabenzylphenol is rapidly converted, principally, to toluene and phenol with a little benzene and p-cresol. Several products are produced from phenylethyl ether; benzene, toluene, ethylbenzene, phenol, ethane, ethylene, and water. Implicit in a portion of the discussion is another important question relating to the structural units in coal. For example, "does it contain any isolated, nonaromatic double bonds." Hydrogen nmr does not show olefinic structure and carbon nmr is ambiguous. A solution based on the stitching and riveting reactions is described. Vitrinite, or a pyridine-soluble fraction of it, was reacted with diborane. Then the hydroborated coal was converted to a trialkylborane derivative by treating it with ethylene gas. Any trialkylborane formed within the coal structure was finally converted to a radioactive-labeled ketone by treatment with radioactive carbon monoxide, or with labeled cyanide ion, followed by hydrolysis. A determination of the specific carbon-14 activity enabled calculation of the number of double bonds originally present. The above technique is being applied to other coal-derived materials. A summary of the data is tabulated.

7238 **Isopropyl alcohol as a coal liquefaction agent.** Ross, D.S.; Blessing, J.E. (Stanford Research Inst., Menlo Park, CA). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 208-213(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Evidence is presented that isopropyl alcohol can act as an H-donor solvent, yielding products similar to those generated in tetralin-based systems. Contrary to the case for tetralin, it appears that the action of the isopropyl alcohol can be promoted by the presence of bases. It is concluded that isopropyl alcohol can act as an H-donor solvent for coal conversion in a process involving hydride transfer from the alcohol, or alkoxide salt, to the coal.

7239 Hydrodesulfurization in the solvent refined coal process. Pitts, W.S.; Tarrer, A.R.; Guin, J.A.; Prather, J.W. (Auburn Univ., AL). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 214-224(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

An experimental evaluation is made of the feasibility for accelerating HDS of coal by simply varying reaction conditions and utilizing coal mineral matter and/or other cheap regenerable catalysts. The rate data reported were all obtained in a batch system; and, except for one series of experiments, only one coal type, a bituminous Kentucky No. 9/14, was used. A reaction model was developed that gives an excellent fit to the experimental data. The model, as well as other results of the comparative studies performed, is intended to assist in predicting and interpreting results from pilot studies of the SRC process, such as those at Wilsonville, Alabama, and Tacoma, Washington. The model provides also a useful design tool; but, for a reaction system as complex as the one dealt with here, it would be presumptuous to suggest that it represents the true mechanism. Hydrodesulfurization reactions occur, under reaction conditions used in the SRC process, at a rate that is practically independent of hydrogen concentration. Reduced iron has a catalytic affect on HDS reactions; in fact, it exhibits a significant memory effect. Because of additional H_2S product, pyrite has only a slight catalytic effect on HDS reactions. The retardation of HDS reactions by H_2S product is one to catalytic inhibition as well as thermodynamic effects. HDS reactions can be modeled as two first-order reactions occurring in parallel, with two widely different rate constants.

7240 Char-oil-energy development (project COED). Jones, J.F. (FMC Corp., Princeton, NJ). pp 1.255-1.260 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Details of the COED process for coal liquefaction are given. The technology of coal pyrolysis, oil filteration, and hydrotreating is reviewed. Product usage and commercial outlook for the process are discussed. (JRD)

7241 Synthoil process for converting coal to nonpolluting fuel oil. Akhtar, S.; Yavorsky, P.M. (Energy Research and Development Administration, Pittsburgh). pp 1.269-1.271 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

High-sulfur coals may be converted economically to clean-burning liquid fuels by the Synthoil process. A slurry of coal in recycle oil is reacted with hydrogen in the presence of a catalyst in a turbulent-flow, packed-bed reactor at 450°C and 2000 to 4000 psi. Under these conditions, coal is converted to liquid hydrocarbons, and sulfur is eliminated as gaseous hydrogen sulfide (H_2S). The liquids and unreacted solids are separated from the gases and centrifuged to obtain a low-sulfur, low-ash liquid fuel suitable for power generation. Although designed primarily for the conversion of coal to a utility fuel, this Bureau of Mines process is easily adaptable to the production of synthetic crude, distillate fuels, or naphtha if the economics justify. The key to the long-term operability of a packed-bed reactor with coal slurry is the turbulent flow of hydrogen. Turbulence prevents plugging of the reactor and facilitates mass and heat transfer.

7242 Consol synthetic-fuel process (CSF process). Phinney, J.A. (Conoco Coal Development Co., Library, PA). pp 1.276-1.281 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The Consol synthetic-fuel process (CSF process) consists of the partial conversion of coal into an extract and a by-product solid residue, followed by hydrogenation of the extract to yield a synthetic crude. Further conversion of the crude to marketable distillates and the manufacture of the hydrogen needed for the process are presumed to use commercially proved methods and have not been part of the CSF development. Most of the development work has been applied to caking, high-sulfur eastern (United States) coals. Based on the work to date, the CSF process has been judged technically feasible by various independent appraisals. It is recognized that modifications and mechanical revisions are needed at the Cresap, West Virginia, pilot plant to achieve better onstream performance. As of mid-1974, the Cresap pilot plant was the only existing large-scale installation owned by the Office of Coal Research which has the facilities for optimizing the production of low-sulfur utility fuels from highly caking eastern coals. Commercial interest in the project continues.

PYROLYSIS AND CRACKING

REFER ALSO TO CITATION(S) 7206, 7319, 8375

7243 Effect of additives on the thermal degradation of peat. Drozhalina, N.D.; Rakovskii, V.E.; Bulgakova, N.O. (Inst. of Peat, Minsk). *Khim. Tverd. Topl.;* No. 2, 16-22(1977). (In Russian).

The action of inorganic and organic additives on the thermal degradation of peat and the formation of a porous carbonized product is examined. Both acid and base inorganic additives are shown to have a catalytic influence on peat pyrolysis, change the yield and properties of the end products and enhance directional structuring of carbn materials. 5 tables, 1 diagram, 29 references.

7244 Characteristics of Oleneskii boghead coal from thermal degradation data. Klestment, I.R.; Rikken, Yu.T.; Urov, K.E. (Inst. of Chemistry, Tallin, USSR). *Khim. Tverd. Topl.;* No. 2, 126-132(1977). (In Russian).

The organic matter of Olenenskii boghead coal was studied by thermal degradation in combination with complex chromatography and spectral methods. Data were obtained on the nature of carbon chains in the bitumoid and in the insoluble portion of kerogen; the genesis of sapropelites is examined. 2 tables, 3 diagrams, 16 references.

7245 Oxidative desulfurization of coal. Friedman, S.; LaCount, R.B.; Warzinski, R.P. (Pittsburgh Energy Research Center). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 100-105(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Results of experimental benefication of coal to remove sulfur are presented. It was found that treatment of coal with compressed air and steam at 150 to 200°C represents a practical method to desulfurize to acceptable levels a sizable percentage of the available coal in the eastern United States at a cost in money and fuel value less than coal conversion and to an extent greater than can be achieved by physical depyriting methods.

7246 Toscoal process for pyrolysis of coal. Carlson, F.B. (Oil Shale Corp., Golden, CO). pp 1.272-1.275 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The Toscoal process for upgrading low-heating value through pyrolysis is described. Toscoal pilot plant test results are tabulated and discussed along with Toscoal char properties, Toscoal oil properties and Toscoal gas analysis. (JRD)

SOLVENT EXTRACTION

REFER ALSO TO CITATION(S) 7319

7247 Coal purification by solvent refining. Johnson, W.G.; Thigpen, P.L. (Rust Engineering Co., Birmingham, AL). pp 1.282-1.284 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

One approach to the problem of meeting air-quality standards when coal is used as a fuel is to remove contaminants from the coal before burning it. The process begins with coal washing and preparation at the mines. The first major extension to further purification of coal is the solvent refined coal (SRC) process, which has been under development since the early 1970s and for which a 50-ton-per-day demonstration plant is being built (1974) by the Rust Engineering Company at Fort Lewis, Washington (under contract to the Pittsburgh and Midway Coal Mining Company). This process produces a water-free low-sulfur, low-ash coal that can be burned as a liquid or a solid. In its solid state, the coal is sufficiently brittle to grind readily into powder. The heating value of the refined coal is about 16,000 Btu per pound without regard to the original coal from which it is produced. Somewhat simplified, the process consists of the following steps: (1) coal preparation and pulverizing to a fine particle size (approximately 200 mesh); (2) blending of the fine coal with a coal-based hydrocarbon solvent that is produced internally in the process; (3) reaction at a high temperature (up to 900°F) and high pressure (up to 2400 psig) of the coal-solvent blend with hydrogen or a hydrogen/carbon monoxide synthesis gas mixture; (4) mineral separation to remove the ash by hot, pressure filtration, followed by drying to recover the solvent;(5) solvent recovery, utilizing high-temperature vacuum flashing, and distillation for separation of various hydrocarbon oil fractions, which can be returned to the process or sold; (6) removal of a gas containing the evolved sulfur compounds; and (7) product solidification to a flake or prill form; or the low-ash low-sulfur product can be used directly from the process as a hot liquid. Test work has indicated that coal of

almost any quality except possibly anthracite is amenable to refining by the SRC process.

BY-PRODUCTS

REFER ALSO TO CITATION(S) 8423

PROPERTIES

REFER ALSO TO CITATION(S) 7191, 7246, 7277, 7278, 7301, 7910

7248 (TID—28507) **Hydrogen bonding in asphaltenes and coal. Final report.** Li, N.C.; Tewari, K.C. (Duquesne Univ., Pittsburgh, PA (USA). Dept. of Chemistry). Apr 1978. Contract EY-76-S-02-0063. 25p. Dep. NTIS, PC A02/MF A01.

Asphaltene fractions show larger aromaticities, larger percent of aromatic hydrogen and smaller aliphatic branches as compared to the heavy oil fractions. The effect of catalyst on the asphaltene fraction seems to increase the aromatic/benzylic ratio, aromaticity and atomic C/H ratio. We may, therefore, consider that asphaltenes contain labile benzylic hydrogens that are removed with the conversion of asphaltenes to oil. Coal liquid fractions are complex mixtures of substituted heterocyclic aromatics and there are varying degrees of aromatic π-π, charge-transfer, H bonding and dipole-dipole interactions. The observed values of K and ΔH^0, therefore, correspond to the total interaction involving these equilibria. Although there is large variation in the ΔH^0 values, the computed K values for the interaction of quinoline with the three asphaltene fractions or with heavy oil fractions, within experimental errors, are the same. This leads us to believe that enthalpy change is a more important measure of the strength of molecular interactions in these systems. Since the severity of process, as mentioned earlier, has no effect on the aromaticities, aromatic/benzylic hydrogen ratio and atomic C/H ratio of the three isolated heavy oil fractions, the observed variation of ΔH^0 for Qu-HO systems, could be viewed on the basis of varying degree of hydrogen bond interactions involving largely aromatic phenols which serve as hydrogen donors to quinoline.

7249 (TSR—78/3, pp C1-C11) **Bulk density of Pittsburgh No. 8 and Kentucky No. 9 coals at room temperature, Appendix C. Interim progress report.** Chung, C.I. (Rensselaer Polytechnic Inst., Troy, NY). Apr 1978.

In Coal pump development and technical support. Quarterly project report No. 3, 27 February—2 April 1978.

We have measured the bulk density of Pittsburgh No. 8 coal (8/40 mesh) and Kentucky No. 9 coal (8/40 mesh) at room temperature as a function of pressure for the pressure range of 0 to 1500 psi. The bulk density of the 8/40 mesh coal samples increases very sharply with pressure up to about 200 psi and continues to increase slowly with pressure to 1500 psi. This finding has an important implication for the screw design. Computer calculations such as Extrud Program should use the correct bulk density of the solid bed along the screw channel as pressure is developed. Pittsburgh No. 8 has a significantly higher bulk density than Kentucky No. 9. The Ln (bulk density) of the 8/40 mesh coal samples increases almost linearly with Ln (pressure) in the pressure range of 0 to 1500 psi.

7250 **Preparation of polished sections and the structure of natural coal.** Weidmann, E.; Kopp, W.U. (Grubbs (K. und B.) Instrument G.m.b.H. und Co. K.G., Duesseldorf (Germany, F.R.)). *Prakt. Metallogr.;* **15**: No. 6, 287-301(Jun 1978). (In German).

A short review of the formation, composition, and structure of the coals is presented. Various quantitative and qualitative methods for structural analysis are mentioned. Different methods of preparation of the various coals are described in more detail. Examples of structures are explained using micrographs, considering the optical equipment in a metallographic laboratory.

7251 **Effect of carbonate minerals on volatile matter of coals.** Choudhury, S.S.; Ganguly, P.C. *Fuel;* **57**: No. 3, 175-178(Mar 1978).

Coals high in carbonate minerals show abnormally high VM on dmmf basis. This abnormality has been shown to be due to the presence of iron carbonate. Effects of the presence of different carbonate minerals on VM have been estimated, and a formula is advanced for estimating VM on dmmf basis of a coal having a particular distribution of carbonate minerals.

7252 **Rock magnetism burned by subground fire in the coal mines of Kuzbass.** Kiselev, V.M.; Aparin, V.P. *Geol. Geofiz.;* No. 2, 121-128(Dec 1977). (In Russian).

The specificity of magnetic properties of burned rock which formed in the area of subground fire lies in their exceptional stability and complete acidity of their ferromagnetic phase. The studies of several burned rock massifs using paleomagnetic method and Telier's method of rotary momenta indicates the valuable properties of burned rocks for reconstructing the field intensity and paleomagnetic reconstructions.

7253 **Infrared-spectroscopic study of coal and solid waste from thermal treatment.** Kekin, N.A.; Gamazina, G.A. (Ukranian Scientific-Research Coal-Chemical Inst., Kharkov). *Khim. Tverd. Topl.;* No. 2, 10-15(1977). (In Russian).

The existing method of studying coal and solid waste from thermal treatment by means of infrared spectroscopy is shown to be inaccurate. A new method is proposed which would yield fuller information about the nature of change in the content of functional groups in coal during heating. 3 tables, 2 diagrams, 11 references.

7254 **Vitrain bitumens of the metamorphic series of Donetsk Basin coal.** Polovnikova, I.A.; Sarbeeva, L.I.; Silina, N.P.; Shubina, V.N. *Khim. Tverd. Topl.;* No. 2, 37-45(1977). (In Russian).

A comparative analysis is made between two types of vitrains differing in reducibility and their bitumens as illustrated by a metamorphic coal series of the Donetsk Basin. 4 diagrams, 2 tables, 9 references.

7255 **Effect of a vibrational mill operation on the properties of coal oxidation products.** Zharova, M.N.; Ekaterinina, L.N.; Motovilova, L.V.; Lebedev, V.V.; Khrenkova, T.M.; Chubarova, M.A. *Khim. Tverd. Topl.;* No. 2, 65-70(1977). (In Russian).

Physico-chemical studies were made of the effect of a vibrational mill on the composition and properties of the oxidation products of lean hydrogenous coal. During vibrational milling of humic acids, processes of mechanical destruction occur, accompanied by changes in fractional and chemical composition, a decrease in the average molecular masses, and a change in the content of the acid functional groups. 3 diagrams, 4 tables, 9 references.

7256 **Nuclear magnetic resonance study of water adsorption by coal.** Alekseev, A.D.; Krivitskaya, R.M.; Pestryakov, B.V.; Serebrova, N.N. (Donetsk Physical-Technical Inst., USSR). *Khim. Tverd. Topl.;* No. 2, 94-97(1977). (In Russian).

A nuclear magnetic resonance study has shown that the adsorption energy of artificially dampened coal is the same when all conditions are equal to that of natural sorption. The freezing point depression of the adsorbed water is 3 to 4 times greater for anthracite than for the remaining coals. The change in the amount of aliphatic carbon was calculated for coal brands T and A, and the effect of that factor on the magnitude of adsorption interactions was demonstrated. 2 diagrams, 8 references.

7257 **Nitrogen forms and amino acid composition in peat-forming plants and in lowland type peat.** Mal, S.S.; Slivka, E.M. (Inst. of Peat, Minsk). *Khim. Tverd. Topl.;* No. 2, 109-118(1977). (In Russian).

Nitrogen forms and amino acid composition in peat-forming plants of lowland swamps and in lowland type peat were studied. The results indicate the significant role of the melanoidinoic reaction in the formation of biochemically stable nitrogen-containing compounds as well as in the accumulation of nitrogen in the peat genesis process. 3 tables, 2 diagrams, 17 references.

7258 **Adsorption of hexanol and hexanoic acid in microcomponents of oxidized metabituminous coal.** Butuzova, L.F.; Kucher, R.V. (Inst. of Physical-Organic Chemistry, Minsk). *Khim. Tverd. Topl.;* No. 2, 119-125(1977). (In Russian).

As illustrated by Donets coal brand Zh, a consistent change in the content of the oxygen-containing groups during oxidation ($t = 150^0$) is shown to fit into the general arrangement of macroscopic stages of hydrocarbon oxidation by atmospheric oxygen. A clarification of such analogies is important for explaining the coal oxidation mechanism. The adsorptive capability of coal in comparison to that of surfactants depends on the nature of the reagent as well as on the petrographic composition of coal and the extent of its oxidation. Changes in adsorptive capability during oxidation are connected to changes in the content of active oxygen-containing groups on the coal's surface. The nature of the interaction of hexanol and hexanoic acid with oxidized coal is discussed. 4 diagrams, 2 tables, 21 references.

7259 **Mechanism of surfactant adsorption on coal.** Basenkova, V.L.; Zubkova, Yu.N. (Donetsk State Univ., USSR). *Khim. Tverd. Topl.;* No. 2, 137-140(1977). (In Russian).

The adsorption of certain surfactants on coal at various stages of metamorphism was studied. The effect of hydrochloric and nitric acid treatment of coal on surfactant adsorption of variable character from solutions and from the vapor phase was demonstrated. Hypotheses are offered on the method of surfactant molecular orientation on coal surfaces. 3 diagrams, 9 references.

7260 **Anode oxidation of graphite in aqueous electrolytes.** Sapunov, V.A.; Shapranov, V.V.; Bergman, R.; Shulika, V.I. (Inst. of Physical Chemistry, Kiev). *Khim. Tverd. Topl.;* No. 2, 153-154(1977). (In Russian).

Water-soluble products containing mellitic acid are shown to be formed in the electrochemical oxidation of graphite. The current yields of those products were determined in relation to electrolysis temperature. 1 table, 13 references.

7261 Use of vitrinite reflectance for coal classification. Karboviac, D. Paris; Association Tech. Siderurgie (1977). 8p. (In French).

Vitrinite reflectance is defined and its measurement is described. Classification of coal from the Marienau station by volatile matter index, AFNOR expansion index, and by vitrinite reflectance is reported. The effect of the wavelength of the light used in assessing the reflectance is discussed.

7262 Sulfidation of coal char and synthetic chars. *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 14-27(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

The interaction between chars and gas mixtures containing H_2S was studied. It was found that in the absence of impurities such as iron, the ability of chars or carbons to absorb significant amounts of sulfur in a sulfidizing gas such as a H_2-H_2S mixture depends on the state of crystallinity of the carbonaceous material. The sulfur absorption decreases with increasing crystallite size. In general, carbons having a mean crystallite size of about 15 A or less absorb significant amounts of sulfur when treated in H_2-H_2S mixtures. For carbons with a given crystallite size, the higher the pore surface area the higher is the amount of sulfur absorbed.

7263 Composition of selected fractions from coal tars produced from an underground coal gasification test. King, S.B. (Laramie Energy Research Center, WY). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 169-184(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Results of analysis of the weak acid and aliphatic fractions of a coal tar produced from an underground coal gasification test are presented. The weak acids are composed of alkylated phenols. The aliphatics have a normal saturate series running from C_{10} to C_{32} with some branched saturates and a particularly heavy concentration of C_{19} branched saturates. The most important point is the similarity of samples over the life of a system or from test to test. This similarity or constancy indicates the following: (1) as a fuel or petrochemical feedstock, a constant feedstock would be very desirable; (2) the unchanging composition suggests a system approaching steady-state conditions; (3) environmental problems would be reduced if the effluent was constant in composition, thereby limiting the number of components to be monitored. As a by-product, the coal tar appears to be advantageous which increases the attraction of underground coal gasification as a commercial process.

7264 Aging characteristics of coal liquids. Karn, F.S.; Brown, F.R.; Sharkey, A.G. Jr. (Energy Research and Development Administration, Pittsburgh). *Am. Chem. Soc., Div. Fuel Chem., Prepr.;* **22**: No. 2, 227-232(1977). (CONF-770301—P4).

From 173. national meeting of the American Chemical Society; New Orleans, LA, USA (20 Mar 1977).

Aging tests were made on three coal liquids from SYNTHOIL run FB-53. Run FB-53 was made with a West Virginia coal (Pittsburgh Seam, hvAb) and operated at 4000 psig H_2 and 450°C. Pelleted $CoO—MoO_3—SiO_2—Al_2O_3$ catalyst was used in the reactor. The samples investigated were from batches 1, 21, and 50 which were obtained after 4, 84, and 200 hours, respectively, of operation of the coal liquefaction reactor. Results of the aging tests are tabulated and analyzed. The data provide some insight into the effects of time, heat, light, mechanical agitation, and gaseous environment on SYNTHOIL aging. Further analyses underway include solvent and chromatographic separations and spectral identification of the aging products. These should help to establish a mechanism for aging and perhaps suggest inhibitors which will improve the storage characteristics of SYNTHOIL.

7265 Coal: properties and statistics. pp 1.15-1.33 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Information concerning the properties of coal is given. Coal types are defined and classified by rank. Commercial sizes of coal are listed and statistics on coal production and consumption are given. (JRD)

7266 Coal testing. Savage, K.I. (Commercial Testing and Engineering Co., Chicago). pp 1.48-1.62 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Testing of coal is described. Information is included on coal characterization tests, coal classification, washability, coking coals, liquefaction and gasification testing, coal sampling, and quality control. (JRD)

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 7942, 8657

7267 (ANL/CEN/FE—78-9) **Regeneration of calcium sulfate from fluid bed combustion of coal: process design and cost estimate.** Southwick, L.M.; Atkins, W.T. (Mittelhauser Corp., Lisle, IL (USA)). Jul 1978. Contract W-31-109-ENG-38. 32p. Dep. NTIS, PC A03/MF A01.

This report presents the design and cost estimate of a limestone regeneration process developed by the Chemical Engineering Division of Argonne National Laboratory which regenerates the spent limestone used to absorb sulfur dioxide in a fluid bed combustion (FBC) boiler. The combustor-regenerator system is based on a combustor design given in the Energy Conversion and Alternative Systems Study by General Electric. The combustor is comprised of four trains with a combined power generating capacity of 800 MW. Two different regeneration designs were considered. The first uses a vacuum lift to move the spent sorbent from the combustor to the regenerator. The second design employs a pressure lift for solids transport. The process designs for these cases are presented in Figures. The total installed capital costs were determined to be $7.4 million for the vacuum-lift case and $7.8 million for pressure lift. Regenerator annualized costs are 1.18 mills/kWh and 1.06 mills/kWh, respectively, for the two cases. These costs do not include the cost of the combustor modifications required for the pressure lift case. These costs will be considerable and would therefore make the vacuum lift case the most economic. Also, these costs do not include the cost of the sulfur recovery process which is required to remove sulfur from the regenerator off-gas. A recent study by Westinghouse showed that the sulfur recovery process cost is considerably greater than the cost of sorbent regeneration. These costs must be evaluated before the cost effectiveness of sorbent regeneration is known.

7268 Rock stripped from the Kansko-Achinskii Basin as raw material for the production of agloporit (a porous aggregate for concrete). Ratynskii, V.M.; Androsov, B.N.; Itkin, Yu.A.; Yurovskii, A.Z. *Khim. Tverd. Topl.;* No. 2, 102-108(1977). (In Russian).

Rock stripped from active coal pits is described and tested by the grooving method. The strip pit rock, primarily represented by sand-clay layers, exhibits quite wide variations in their composition both in their surface and cross-section. Representative tests of the pit rock were made in the laboratory and on a bench unit. On the basis of the experimental tests a part of the strip pit rock was found to be suitable for manufacturing agloporit. Technological parameters of furnace charge sintering are recommended for subsequent technological studies for agloporit production. 6 tables, 1 diagram, 4 references.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 8856, 8857, 8858, 8871, 8873

7269 (DOE/EV—0015) **Division of Environmental Control Technology program, 1977.** (Department of Energy, Washington, DC (USA). Div. of Environmental Control Technology). Jun 1978. 153p. Dep. NTIS, PC A08/MF A01.

Environmental engineering programs are reviewed for the following technologies; coal; petroleum and gas; oil shale; solar; geothermal and energy conservation; nuclear energy; and decontamination and decommissioning. Separate abstracts were prepared for each technology. (MHR)

7270 (DOE/EV—0015, pp 5-37) **Coal.** Jun 1978.

In Division of Environmental Control Technology program, 1977.

Twenty-three projects of US DOE involving air or water pollution control at fossil-fuel power plants, coal gasification plants, coal preparation plants, in-situ gasification, surface coal mines, etc., are described briefly. The principal investigator(s), objectives, approach, progress and results, reports published and plans for the next period are given. (LTN)

7271 (ORNL—5361) **Environmental and health aspects of disposal of solid wastes from coal conversion: an information assessment.** Braunstein, H.M. (ed.). (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 354p. Dep. NTIS, PC A16/MF A01.

Ash, slag, elemental sulfur, and possibly organic sludge will be produced in large quantity by coal conversion facilities. Thus, in the absence of sufficient mechanisms for utilizing these wastes, environmentally acceptable disposal methods will be needed. This document summarizes information necessary for evaluating landfill storage of coal conversion solid wastes in terms of potential environmental and health effects. Conversion wastes comprise a wide range

of process-related substances with varied and often uniquely individual physical, chemical, and toxicological properties. Therefore waste behavior in a landfill is a complex result of a multitude of interactions of the deposited compounds with the hydrological, geological, and morphological features of the burial site. Additionally, microbial and chemical activity are important parameters in determining mobility and thus, stability of landfill materials. Loss of material from a landfill that contains solid waste can result in various types of contamination of groundwater and surface water. For example, ash or slag leachate may contain dissolved toxic heavy metals; organic sludge can be transported out of the landfill as microdroplets of potentially carcinogenic polycyclic aromatic hydrocarbons; and fine particulate sulfur in the presence of oxygen can give rise to highly acidic leachate. Additionally, ultrafine ash particles may be released from the fill and transported to groundwater as suspended particulates in flowthrough current. Because coal conversion solid wastes appear to have the potential for environmental disruption, definitive studies of landfill disposal are needed to generate data to ascertain the environmental safety of landfilling specific wastes using various techniques.

7272 (RLO—2228-T3-4) **Successional development of vegetation on surface mined lands in Montana.** Sindelar, B.W. (Montana State Univ., Bozeman (USA). Dept. of Animal and Range Sciences). 1978. Contract EY-76-C-06-2228. 12p. (CONF-7806113—1). Dep. NTIS, PC A02/MF A01.

From Congress for energy and the ecosystem; Grand Forks, ND, USA (12 Jun 1978).

A study to investigate plant establishment, succession, stability and permanence of plant communities, and kind and rate of concurrent soil and vegetation development was initiated near Colstrip, Mt. in 1975. Revegetated mining sites from several months to nearly 50 years old are being studied. Montana reclamation law requires establishment of "permanent diverse vegetative cover" capable of feeding livestock and wildlife, limiting soil erosion, and persisting under prevailing environmental conditions. Preliminary analyses indicate that some early successional stages associated with soil formation might be bypassed in reclamation by topsoiling, fertilization, mulching, and seeding mixtures of plant species. Plant succession is strongly influenced by variables including species seeded, initial seeding success, cultural practices, and weather. Evidence provided by revegetated spoils nearly 50 years old suggests considerable potential for reclamation success, provided that spoil materials have adequate moisture holding capacity and proper management.

7273 **Potential environmental impacts from the production of synthetic fuels from coal.** Paris; Organization for Economic Cooperation and Development (1977). 54p.

As part of a study to provide member governments of the OECD with policy options or guidelines to prevent or minimize environmental conflicts, the impacts of coal conversion to liquid or gaseous form are reviewed. The technologies of conversion are discussed, together with the potential environmental impacts that must be controlled at the plants, the current state of control technology and the evaluation of sites.

7274 **Seeding and planting to achieve land-management objectives.** Plass, W.T. (Dept. of Agriculture, Princeton, WV). pp 1.102-1.116 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Development of mined areas for maximum benefits is discussed. Information is induced on site evaluation, preparation of the site, seeding and planting, and land-management options. (JRD)

RESERVES AND EXPLORATION

REFER ALSO TO CITATION(S) 7310, 7423

7275 (NP—23430) **Mining in the Hanna Coal Field.** Glass, G.B. (Wyoming Geological Survey, Laramie (USA)). 1972. 47p. TIC $1.00.

7276 **Construction and analysis of isocorrelation maps for forecasting and surveying hydrogenous coal.** Mikhailov, V.I.; Tyashkevich, I.A. *Dokl. Akad. Nauk BSSR;* **21**: No. 2, 156-159(Feb 1977). (In Russian).

With the aid of isocorrelation maps, an examination is made of the interconnection between the relief of a 3rd order basic surface and the surface of cretaceous and saliferous deposits. Areas of complete coincidence between local structural forms and inverted structures were identified on the maps. All of the known coal manifestations in the examined area turned out to be associated with negative depressions of correlation relief. Subsequent to an analysis of the isocorrelation maps, an attempt was made to forecast hydrogenous coal deposits that are associated with trough-like sags in Neogene-Paleogene strata.

7277 **Reducibility of humic coal.** Lapin, A.A. *Khim. Tverd. Topl.;* No. 2, 46-52(1977). (In Russian).

As a result of analyzing differences in the properties of petrographically related and uniformly carbonized coal, concepts are presented, in the light of modern views of the chemical nature of coal, on the genetic reducibility of coal as a level of change in the chemical structure of coal organic mass in relation to the extent of carbonization. Occupying a special place in this analysis is the hypothesis about synthesis reactions which took place in the formation of caking coal containing from 80 to 86% carbon. Depending on the degree of carbonization, the factors reflecting reducibility are: functional nature (number of oxygen-containing functional groups), number of newly formed bitumens, and stereoregularity of macromolecular aggregates.

7278 **Analyses and measured sections of Pennsylvania bituminous coals. III.** Skema, V.W.; Edmunds, W.E.; Glover, A.D.; Inners, J.D.; Sholes, M.A. Harrisburg, PA; Pennsylvania Geological Survey (1977). 275p. $3.65.

Geologic information concerning bituminous coals and associated sedimentary rocks, obtained from strip mines and a few drill holes in 20 counties of western Pennsylvania, is presented. Coal data include seam and bench thickness, megascopic description of composition, proximate and ultimate analyses, major-, minor-, and trace-element analyses, determination of Btu and forms of sulfur, free-swelling index, and ash-softening temperature. Other data presented are thickness of individual rock units, lithologic characteristics (gross composition, grain size, color, etc.), degree of weathering, fossil content, sedimentary structures, bedding and fracture orientation, and overburden characterisitcs.

7279 **Coal reserves: estimates.** McNulty, J.E.; Ball, C.G. (Paul Weir Company Incorporated, Chicago). pp 1.34-1.36 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Data on the location of US and worldwide coal reserves are given. (JRD)

7280 **Coal exploration.** McNulty, J.E.; Ball, C.G. (Paul Weir Company Incorporated, Chicago). pp 1.37-1.47 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The geology of coal, the characteristics of coal, and exploration methods are discussed. Information and data are included on core drilling, coal sampling and analysis, geophysical logging and data compilation. (JRD)

MINING

REFER ALSO TO CITATION(S) 7265, 7272, 7275, 7314, 7315, 7316, 7317, 7318, 7321, 8379, 8959, 8960

7281 (FE—9087-1) **Development of a flexible shaft roof drilling system. Final report, June 26, 1974—January 15, 1977.** (Foster-Miller Associates, Inc., Waltham, MA (USA)). Jul 1977. Contract ET-74-C-01-9087. 68p. Dep. NTIS, PC A04/MF A01.

This report covers the designs, fabrication, laboratory, and underground testing of a flexible shaft roof drill for low coal. This drilling system utilizes a concentric, counterwound, smooth flexible shaft and an intermittent hydraulic torque-thruster. This new roof drill allows remotely operated drilling of holes up to 8 feet deep from a seam as little as 30 inches thick.

7282 **Microseismic research in Polish coal mines.** Trombik, M.; Zuberek, W. (Central Mining Inst., Katowice, Poland). pp 169-194 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

The development of the use of microseismic monitoring (acoustic emissions) in Polish coal mines is reviewed with a discussion of the principles, apparatus, operation of the apparatus and data analysis. (JSR)

7283 (TID—28539) **Methane from coalbeds: collection and utilization systems. Monthly progress report.** (TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.). Apr 1978. Contract EW-78-C-21-8089. 36p. Dep. NTIS, PC A03/MF A01.

This is the first report under TRW Contract No. EW-78-C-21-8089 to implement the engineering and integration effort necessary to the Methane from Coalbeds Program. Activity has been directed primarily at: (1) Resource characterization of "unminable" coalbeds. A drilling plan has been developed and locations for

drilling, coring, and testing are now being evaluated and priorities established. (2) Pilot System Application Project definition and first project selection. The first project is now planned to use vertical wells with stimulation for predrainage gas production and utilization by injection into a commercial pipeline. Several coal companies have indicated they want to have a candidate site considered for this program. The Ranger Fuel Corporation has provided a data package for a candidate site and is currently under evaluation. Preliminary indications are favorable. (3) Program planning support in the development of a draft Integrated Program Plan for DOE Headquarters and a draft Project Plan Document for MERC.

7284 Statistics of the economy - figures of the coal mining from January to May 1978. *Glueckauf;* **114**: No. 15, 678-680(Aug 1978). (In German).

The following are given in tables: Extraction, briquetting, coking, number of employed and electricity industry in German brown coal and pit coal mining; pit coal inventories, products of the coking industry.

7285 Determination of the cutting force components of roller bits of large dimensions. Baumann, L.; Sill, D.; Wehrmann, W. *Glueckauf-Forschungsh.;* **39**: No. 2, 52-56(Apr 1978). (In German).

Large dimensions and machine weights of the full-cutting driving systems require a lot of preliminary and subsequent work which considerably influences the profitableness of the machine drive. Therefore, new methods of non-explosive rock crushing are being developed which by more favorable rock working, enable the building of smaller and lighter drive systems with greater range of application regarding rock solidity and minimum drift. Extensive comparative investigations on common roller bits have been performed for this purpose on a test stand in the pit coal mining society, Essen. The results carried out under reproducible conditions are of basic significance in determining the efficiency and profitableness of the new bore methods to be investigated in the future. As it would not have been possible to manage with the available personnel and common measuring equipment due to the complexity and scope of measurements, a process guide system had to be used for the measured data recording, processing and evaluation. Furthermore, the test was partly controlled by the computer and critical test parameters were simultaneously supervised.

7286 Underground coal mining research. Palowitch, E.R. (Pittsburgh Mining Operations). *Min. Congr. J.;* 34-35, 38-41(Feb 1978).

This review is limited to highlighting technical articles on coal mining research which appeared during the year in the trade journals and in government publications. Detailed information on completed federally funded research can be found in bureau publications and in Abstracts of Mining Production Research Progress.

7287 National Coal Board reports and accounts, March 27 1977—March 25, 1978. London; National Coal Board (1978). 88p. £ 1.

The year 1977/8 began in an atmosphere of considerable uncertainty on the industrial relations front and the disappointing downward trend in output and productivity continued during the first nine months of the year. However, following the progressive introduction of local incentive agreements there was a marked improvement in performance. Opencast operations were once again highly successful with output increasing by nearly 20%. Coal sales to power stations rose to a record level in 1977/8 and the industrial and domestic coal markets were both reasonably firm. There was, however, a major difficulty in the coking market associated with the severe recession in the steel industry. Unremitting attention to cost control enabled the industry to keep the 1978 round of coal price increases in line with the general level of inflation and to show a trading profit of 109 million pounds for the year. Financial prospects for the year 1978/9 show signs of increasing difficulty. Costs continue to rise at the same time, the market weakness in the key sector of coking will continue to depress revenue. The industry undoubtedly faces a very demanding task in maintaining viability in such circumstances. There has been further progress in new investment in accordance with the long-term plans for the industry. About 30 major schemes were authorized during the year bringing the additional output capacity authorized to date to 30 million tons out of a total of 100 million tons envisaged up to the year 2000. (LTN)

7288 Betws Drift Mine. History of the planning and development. Barfoot, R.G. *Proc. S. Wales Inst. Eng.;* **92**: 12-19(Dec 1977).

This paper describes the anthracite reserves which will be mined, the development of Betws Drift Mine and lists some of the equipment which is used there.

7289 Building a new coal industry. Ezra, D. *Proc. S. Wales Inst. Eng.;* **92**: 26-34(Dec 1977).

Reviews the phases of post-war energy development, examines plan for coal and its implementation, and outlines the important features of plan 2000.

7290 Model studies of subsidence and ground movement using laser holographic interferometry. Park, D.W.; Summers, D.A.; Aughenbaugh, N.B. *Int. J. Rock Mech. Min. Sci.;* **14**: No. 5-6, 235-245(Nov 1977).

Laser holographic interferometry is a method of remotely monitoring surface movement even on the surface of granular material in three dimensions, without the surface disturbances associated with instrument emplacement. In this study models of longwall and room and pillar layouts were used to demonstrate the validity of the technique and, subsequently, to generate data as the parameters controlling displacement were varied. The effects of cavity size, depth and orientation and material elasticity, time and geologic structure on surface displacement were analyzed. Gelatin and sand were successfully used as model materials in the study, which has demonstrated that laser holographic interferometry is a practical system with potential to examine complex structures such as multiple panel extraction in longwall, multiple seam extraction or extraction of seams associated with irregular geologic conditions which might otherwise be difficult to monitor.

7291 Application of microseismics in coal mines. Leighton, F.; Steblay, B.J. (Bureau of Mines, Denver). pp 205-229 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

This paper describes the instrumentation, techniques, and results of current microseismic investigations by the Bureau of Mines in coal mines. Rock noises were monitored in a deep western Colorado coal mine for the purpose of studying the phenomena of coal mine bounces (seismic energy releases large enough to damage the structure). Data preceding several bounces of varying magnitude were recorded and analyzed. Techniques were developed to locate and delineate bounce areas within the mine structure and to estimate the stability of individual suspect areas. Analysis of these data indicates that microseismic techniques may be used to establish where and when coal mine bounces will occur. Microseismic equipment, sensitive to frequencies in the ultrasonic range, was also used to monitor a controlled roof fall experiment at the Bureau's experimental mine at Bruceton, Pa. The equipment used detects noise in the ultrasonic range, where cultural noise is minimized, and translates these frequencies down to the audible range. Results of this experiment indicate that the peak buildup of rock noise occurred about 15 minutes prior to roof failure, and that the equipment may be usable as a warning system to predict roof falls.

7292 Seismic source location in the Ruhr district. Cete, A. (Ruhr-Univ., Bochum, Ger.). pp 231-269 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Seismic monitoring for prediction of rock bursts in coal mines of the Ruhr district is done by a network of ground stations. Expansion of mining area has led to the need for the expansion and modernization of the network, but as economically as possible. The present theoretical aspects of locating potential rock bursts and the type of instrumentation being conceived are described. (JSR)

7293 Monitoring the stability of geologic structures using near-surface microseismic transducers. Hardy, H.R. Jr. (Pennsylvania State Univ., University Park). pp 357-379 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Since 1970 the Rock Mechanics Laboratory at The Pennsylvania State University has been involved in microseismic studies associated with the evaluation of stability in geologic structures. To date the major field effort has been concentrated on two projects, namely: (1) Study of underground gas storage reservoirs, with the purpose of developing techniques for evaluation of the mechanical stability of such structures as a function of storage pressure and duration, and (2) Study of the feasibility of using surface mounted microseismic transducers for investigating the mechanical stability of underground coal mines. Both projects are directly related to the economics and safety interests of the gas and coal industry, and as such are particularly appropriate in light of the current energy shortage. The above projects have been unique in that measurements have been made using near-surface rather than underground transducers. The use of such near-surface transducers offers a number of important advantages, as well as a number of disadvantages, and the

purpose of this paper is to discuss these in light of the two projects presently underway.

7294 Proiskhozhdenie, profilaktika i tushenie endogennykh pozharov v ugol'nykh shakhtakh. (Origin, prevention, and quenching of endogenic fires in coal mines). Lindenau, N.I.; Maevskaya, V.M.; Krylov, V.F. Moscow; Nedra (1977). 320p.

Results of research on establishing the relationship between the degree of coal spontaneous combustibility and their genesis and mining-geological factors are presented. An examination is made of methods for determining the degree of coal spontaneous combustibility from test samples taken from mining operations and geological survey boreholes. Characterisitcs are given for the extent of coal spontaneous combustibility within the area of a seam, and methods are indicated for predicting coal spontaneous combustibility in stripped horizons and coal deposits being surveyed. Results are given for simulating coal spontaneous combustion and quantitative values are given for the basic factors which contribute towards its development. A method is proposed for predicting endogenic fire hazard in coal fields and examination is made of fire-proof methods of stripping, preparation, mining systems, ventilation systems for mines and coal fields as well as special fire prevention measures. An examination is made of methods and means of extinguishing endogenic underground fires and situations in which such methods should be used. The book is intended for engineering-technical personnel at coal industry enterprises, design and scientific-research institutes. 53 tables, 94 illustrations, 90 references.

7295 Roof control for underground mining. Fletcher, R.; Bakoss, J. (J.H. Fletcher and Co., Huntington, WV). pp 1.71-1.83 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Major factors of roof control are discussed including principles of roof mechanics in competent rock, types of roof failure, pillar support, timbering, rigid and yieldable steel arches, masonry support, history and techniques for roof bolting, elements of applied roof bolting, rock-drillability determination, roof-drilling equipment, and technological trends.

7296 Contour mining. pp 1.94-1.101 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Contour mining is discussed. Information is included on conventional methods, haulback methods, valley fill methods, mountaintop leveling, augering, coal loading, hauling units, and hauling conditions. (JRD)

7297 Optimizatsiya razvitiya otkrytykh gornykh rabot. (Optimization of the development of open-pit mines). Polishchuk, A.K.; Polishchuk, G.K.; Mikhailov, A.M. Moscow; Nedra (1976). 159p.

The criterion for evaluating the development of open pit mines in the working of complex structured ore and non-ore deposits is substantiated. An analysis is given for the relationship between this criterion and the lithological structure of the stripped rock, the mining of useful mineral by-products, and expenditures for exclusion and recultivation of disturbed land. Methods are presented for optimizing parameters of mining systems, economic-mathematical modeling of horizontal deposits, and determining the optimal development of open pit mining. Methods are presented for determining the production capacity of an open-pit mine, the manner in which a calendar plan can be compiled for joint open pit working, and methods for making future quarterly and monthly plans for open pit operations. 12 tables, 39 illustrations, 23 references.

7298 Vyemka uglya buroshnekovym sposobom. (Mining of coal by drill-auger methods). Yagnakov, A.F.; Semenov, Yu.N.; Lebedev, V.E. Moscow; Nedra (1976). 120p.

A descripton is given of the state of the art and experience in auger-drilling of coal in the USSR and abroad in which process the drilling of boreholes is undertaken directly on the entire seam mined and the roof is controlled by residual inter-borehole pillars. Shortcomings which limit the use of this system are examined. Substantiation is offered for selecting a new engineering system for drilling out holes for coal seams having a width of 0.9 meters and more; results are given for the experimental-industrial testing of this system. Designs and results are presented for tests made by drilling groups. Requirements are presented for building a drill-auger mining machine and a description is given of its construction, parameters and operational principles. An examination is made of tests results for the drill-auger mining machine, the basic parameters of the engineering system with counter-boring, and the conditions and areas in which counter-boring machines can be rationally utilized. The book is intended for engineering-technical personnel of mines and design-construction institutes. 16 tables, 35 illustrations, 29 references.

TRANSPORT AND HANDLING

REFER ALSO TO CITATION(S) 7198, 7210, 7211, 8400

7299 New basis of calculation for belt conveyors. Funke, H. *Glueckauf;* **114**: No. 15, 658-662(Aug 1978). (In German).

The report deals with guidelines on the calculation and design of conveyors for bulk goods as laid down in the standard leaflet DIN 22101. Explanations are particularly given on the determination of the volume and mass flow, motion resistances and required power of a conveyor belt system and of the belt pull and tensions, as well as on the design of the operation system, conveyor belt and drums, connecting curves and lengths.

7300 Quantitative appraisal of separation processes. Pethoe, S.; Ortutay, M. *Glueckauf-Forschungsh.;* **39**: No. 2, 71-75(Apr 1978). (In German).

A mathematical method is introduced by means of which the separation accuracy of processing technical procedures can be quantitatively characterized. This necessitates the mathematical definition of initial grads and products as well as of faulty goods. Error moments related to the compensating separation limit can be developed on this basis. Functions and parameters are set up for an absolutely effective separation (ideal separation) and for an absolutely ineffective separation (division). Based on these two extreme values, i.e. in the region of technical separations according to degree of perfection of the separation, values between 0 and 100 %. The extensive applicability in particularly illustrated by its physical importance and by its use for the description of all physical separations. Its solidity is based on the consideration of quantity and composition of the initial goods and products. The calculation is simple as is demonstrated by an example of coal processing. The effectivity permits a clear assessment.

7301 Influence of the grinding of coal on specific surfaces, the pore structure and the absorption kinetics. Baumann, H.; Klein, J.; Juentgen, H. *Glueckauf-Forschungsh.;* **39**: No. 2, 63-70(Apr 1978). (In German).

As the reaction behavior of coal does not only depend on its chemical constitution, but also to a great extent on the type and size of the inner and outer surface, it is relevant to determine the influence of the surface values by specific grinding. The changes of the inner surface of five pit coals and one coke were measured during grinding in a spherical vibration grinding mill by the CO_2 adsorption. The measurement took place in the mill to avoid the influence of agglomeration or oxidation. Furthermore, the N_2 surface and the Blaine surface on samples ground for various lengths of time in CO_2 atmosphere were determined. The ratio of the Blaine surface to N_2 surface is independent of granulation for coal but increases with increasing granulation in the case of coke. Both surfaces decrease again as a result of agglomeration after one to two hours grinding of coal having an average degree of carbonization. The CO_2 adsorption-measured surfaces are for coal independent of granulation, i.e. the whole inner surface is determined by CO_2. In the case of coke, additional pores are made accessible for CO_2 by grinding. Structure curves for the micropores are calculated from the Dubinin-Radushkevich isotherms with the help of the Kelvin equation on the one hand, and the de Boer-Custers equation on the other. Statements are made on the diffusion rate of the CO_2 and N_2.

7302 New coal dressing plant at Walsum. Becker, M.; Simmering, A.; Ritter, H. *Aufbereit.-Tech.;* **19**: No. 6, 265-270(1978). (In German).

The new dressing plant at Walsum has been the first complete new installation of that kind in the Federal Republic of Germany during the last 10 years. This construction was necessary because the existing washery had been worn down and the capacity of its section for handling fine and superfine material permitted but partial processing. Apart from that, the request for supplying coal of low ash and sulfur content to the new power plant to be set up at Voerde was of great importance. The sizes of the most important machines and equipment are given, and the preliminary results achieved with the plant are presented.

7303 Use of pneumatic spiral and chamber pumps in pneumatic hauling of coal dust. Vtyurin, Yu.N.; Mikhailov, N.M.; Kucherenko, P.P. *Elektr. Stn.;* No. 1, 16-20(Jan 1977). (In Russian).

The conveyance of anthracite coal dust over large distances was tested by the most productive pneumatic chamber and pneumatic spiral pumps at the Krasnogorsk Cement Machinery Plant. Results are given for the installation and testing of a pneumatic chamber pump before rearrangement (with a vertical discharge pipeline) and after rearrangement (with a bottom discharge pipeline). Although the productivity of the rearranged pneumatic chamber pump was shown to be greater than that of the pneumatic spiral pump, the former's operation was less reliable and economical. In addition, the dual chamber pump with its metal construction takes up tens of

times more space than is warranted. It was also established that the productivity of the pneumatic spiral pumps significantly depends on the distance over which material is transported. It was concluded that pneumatic chamber pumps cannot yet be recommended for transporting coal dust at power plants, and that the use of redesigned pneumatic spiral pumps would be more advisable. 7 references.

7304 Coal preparation plants. Draeger, E.A. (McNally Pittsburg Manufacturing Corp., Pittsburg, KS). pp 1.117-1.136 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Coal preparation plants are discussed. Sampling equipment is described along with breaking and crushing equipment. Information is included on screening, cleaning, and dewatering and drying. (JRD)

7305 Coal handling and storage systems. Smardo, P. (McNally Pittsburg Manufacturing Corp., Pittsbugh, KS). pp 1.137-1.152 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Equipment and facilities for coal handling are described. Information is included on facilities for unit trains, barge loading systems, handling systems for coal users, and coal storage. (JRD)

7306 Railroad transportation of coal. Sward, J.D. (Atchison, Topeka, and Santa Fe Railway Co., Chicago). pp 1.153-1.169 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Types of rail service for coal transportation are described including single carload, multiple carloads, trainload volume service, and unit trains. Railroad cars for coal service are also described including open-top hopper cars, gondola cars, and rapid-discharge cars. Information is included on loading systems, unloading systems, terminals, and geographical aspects of coal transportation. (JRD)

7307 Barge movement of coal. Price, W.L. (Dravo Corp., Pittsburgh). pp 1.170-1.177 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Barge movement of coal on inland waterways and intercoastal waterways is discussed. Information is included on economic factors, Gulf intercoastal waterways, Great Lakes movement of coal, loading and unloading of barges on inland waterways, and barge design. (JRD)

7308 Coal transportation by slurry pipeline. Jacques, R.B.; Montfort, J.G. (Black Mesa Pipeline, Inc., Flagstaff, AZ). pp 1.178-1.187 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Coal transport by slurry pipeline is discussed. An early Ohio installation is described along with the Black Mesa Arizona, system for coal slurry transport. The outlook for coal slurry pipelines is evaluated. (JRD)

COMBUSTION

REFER ALSO TO CITATION(S) 7205, 7267, 7900, 7911, 7942, 8414, 8793

7309 (FE—2516-6) Centrifugal fluidized combustion of coal. Quarterly report, January—March 1978. Levy, E.K.; Chen, J.C. (Lehigh Univ., Bethlehem, PA (USA)). Apr 1978. Contract EX-76-S-01-2516. 30p. Dep. NTIS, PC A03/MF A01.

Experiments were performed on the continuous feed and removal of solids with a centrifugal fluidized bed, where solids are fed to the bed from a rotating distributor plate attached to the bottom end wall of the chamber. Material is discharged through tubing inserted through the distributor and air plenum. The data indicate that with these techniques, it is possible to feed and remove solids and achieve a stable bed thickness after a transient start-up period. The steady state thickness of the bed depends on the solids discharge rate. The calibration of the hot fiber anemometer probe was completed. An error analysis of the system indicates extreme sensitivity to orientation of the probe with respect to the velocity vector. With the probe axes aligned 45° to the flow direction, an uncertainty in each velocity component of approximately 5 percent is expected.

7310 Genesis of germanium mineralization and rational methods for the combustion of germanium-containing coal. Ratynskii, V.M. (Inst. of Mineral Fuels, Moscow). *Khim. Tverd. Topl.;* No. 2, 29-36(1977). (In Russian).

The characteristics of prospective germanium-containing coal regions are given on the basis of data on formation processes of germanium-containing coal. The possibility of extracting concentrates from fuel coal that have a higher germanium content than feed coal is examined. A comparison of various methods of burning fuel coal in industrial furnaces indicates that the combustion of coal with a high germanium content should be done in grate-fired and jet-grate-fired furnaces.

7311 Development of a mathematical model for the heating of polydispersed coal in a gas stream. Pustovoitenko, A.I. *Khim. Tverd. Topl.;* No. 2, 141-145(1977). (In Russian).

The heating of polydispersed coal in a gas stream is examined with respect to the finite value for particle thermal conductivity. Calculations made from heating dispersed coal in a medium of combustion products and hydrogen were compared. Research results are cited with reference to the effect of particle slippage relative to gas in the interphase heat exchange process. 4 diagrams, 5 references.

7312 Bomb calorimetry for testing solid and liquid fuels. Steffenson, M.R. (Parr Instrument Co., Moline, IL). pp 1.63-1.70 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Bomb calorimetry of fuels is described. Information is included on bomb calorimeter design and operation, calorimeter selection, safety considerations, and standard methods. (JRD)

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 7287

7313 Coal. Aylsworth, J.A. *Can. Min. J.;* **99**: No. 2, 146-148, 151-153(Feb 1978).

This is an annual review of the Canadian coal industry and gives statistics on production, consumption, and trade.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7281, 7282, 7294

7314 CO monitoring and early fire detection by process computers. Steudel, J.; Kuepper, W.; Hirschberg, D. *Glueckauf;* **114**: No. 15, 647-649(Aug 1978). (In German).

A method for CO monitoring and fire early warning is described as part of an extensive control system for the mining industry. The use of data display units simplifies continuous monitoring of the CO measurement, improves the recording by automatic protocols of average values of measurements every minute, and the early fire warning by trend calculations. The version presented here is developed for process computers which can also take on other monitoring and automatic functions. The first uses in mines were therefore those using process computers of the type 330, Siemens AG. The method was already applied in a simpler version to the mining compound Prosper/Haniel at the beginning of 1977. The program was expanded stepwise in close cooperation with the mine personnel responsible and was also put into operation in the Osterfeld mine in March 1978. The software model construction simplifies further additions or mining changes which can be rapidly applied to other mines.

7315 Medical aspects of the harmfulness of dust. Audran, R.; Quinot, E. *Ann. Mines;* 49-58(Jan 1978). (In French).

This paper reviews the various types of pathology associated with dust and examines the parameters, both physical and physiological which control the deposition of particles in the respiratory tract. The mechanism of the lung's cleansing systems and models of these processes are discussed. Particles not eliminated can give rise to the specific pathogenic effects known as pneumoconioses.

7316 Accidents and disasters in coal mines. London; National Coal Board (1978). 74p.

This report lists many of the accidents in UK coal mines from the early nineteenth century to date. The accidents are listed by colliery and by cause (explosions; rockbursts; rock falls; fire; inundations; in shafts; support failure; haulage runaways; and tip slides). A select bibliography and index by county are included.

7317 Mine Injuries and Worktime, quarterly, January—June 1978. *Mine Inj. Worktime Q.;* 1-18(1978).

All current-year data presented are preliminary and subject to change. The data are compiled from reports by operators of mines for personnel directly engaged in production, cleaning, milling, shipping, development, and maintenance and repair work, including direct supervisory and technical personnel and contract mining services. Reports are submitted as required under the Federal Mine Safety and Health Act of 1977, Public Law 91-173 as amended by Public Law 95-164.

7318 Activities of the Institut d'Hygiene des Mines during 1976. Degueldre, G. *Ann. Mines Belg.;* 1139-1176(Dec 1977). (In French and Dutch).

The medical section's work included systematic staff examination, epidemiological research on miners' chronic bronchitis, and problems arising from the high temperatures in which miners work. The technical sections work included conimetry, comparison between dust measuring methods in various EEC countries, improvements in firedamp and dust control, and process control of ventilation.

7319 Chromatographic analysis of extracts and pyrolysis products of Central Asian pit coal. Urmet, E.A.; Buryakova, E.P.; Rumyantseva, Z.A.; Klesment, I.R.; Urov, K.E. (Inst. of Chemistry, Stalinabad, USSR). *Khim. Tverd. Topl.;* No. 2, 78-83(1977). (In Russian).

The group composition of methanol-benzene and ester extracts and pyrolysis products of Central Asian pit coal was determined by fine-layer and liquid-gas chromatography. The examined products primarily contain oxygenous compounds, the hydrocarbon content ranges from 24 to 40%, and the latter compounds are divided into aliphatic and aromatic hydrocarbons. The aliphatic hydrocarbons are represented by n-paraffins, isoparaffins, including isoprenoid structures and traces of olefins. The aromatic compounds are primarily bi- and tricyclic hydrocarbons. 3 diagrams, 1 table, 13 references.

7320 Connection of the granulometric composition of a graphite filler with the parameters of linear fracturing mechanics. Gusman, N.O.; Chernyatsev, A.N.; Polisar, E.L.; Chernykh, V.A. *Khim. Tverd. Topl.;* No. 2, 150-154(1977). (In Russian).

Two methods for calculating the average size of a filler coke granule are derived by analyzing formulas of mathematical statistics. The grain size characterizes the macrostructure of graphite and determines its physical properties: the effective energy of fracturing and the size of the critical effect. 2 diagrams, 4 references.

7321 Spravochnik po tekhnike bezopasnosti i promyshlennoi sanitarii v ugol'nykh shakhtakh. (Handbook on safety techniques and industrial health in coal mines). Babokina, I.A. Moscow; Nedra (1977). 335p.

The handbook discusses basic problems in safety technique and industrial health in the coal industry. An examination is made of legal questions of safety technique, methods of safe mining and detonating operations, the use of electric and pneumatic power, safety measures in the operation and maintenance of machines, measures for preventing sudden discharges of coal, rock and gas, mine shocks, dust and gas explosions, means and methods for preventing accidents and their elimination. Also cited are measures for the prevention of occupational diseases, and economic recommendations are made for creating safe and healthy working conditions in coal mines. The handbook is intended for engineering-technical personnel and mining supervisors in coal mines and coal industry organizations. It can also be used by workers at design-construction and scientific-research institutes, and by students and instructors at mining teaching institutions and departments. 85 tables, 116 illustrations, 117 references.

7322 Coal mining: safety and health. pp 1.84-1.93 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Mine safety research in ground control, fire and explosion prevention, hazards, methane control, rescue, dust, noise and industrial hygiene is described. Information is also included concerning analysis of fatal accident reports and coal workers pneumoconiosis. (JRD)

PETROLEUM

7323 (LA-UR—77-1765) **Tour of Russian oil field technology.** Rowley, J.C.; Watkins, J.W. (Los Alamos Scientific Lab., NM (USA)). 1977. Contract W-7405-ENG-36. 9p. Dep. NTIS, PC A02/MF A01.

Portions of document are illegible.

As part of U.S.-U.S.S.R. efforts to define potential areas for cooperative projects in energy research and development, oil experts from the U.S. and the Soviet Union exchanged visits. An overview of some aspects of Soviet oil field technology that was gained from a tour of major administrative and technical institutes and three major oil centers in Western Siberia, Baskiria, and Tataria is presented. This paper presents the highlights of the tour, comments on Soviet drilling technology, compares U.S. and Soviet drilling equipment and practices, and recommends areas for cooperative projects in oil technology.

7324 Petroleum industry. Mueller-Michaelis, W. *Brennst.-Waerme-Kraft;* **30**: No. 4, 140-143(Apr 1978). (In German).

The review article gives literature on this subject published in 1977, arranged according to the following aspects: a) consumption, b) meeting the demand, c) refineries, d) long-distance pipelines, e) the use of crude oil, and f) petroleum policies.

7325 Oil and gas international year book, 1978/79. Moore, R. (ed.). New York; Financial Times (1978). 777p. Financial Times, Business Publishing Div., P.O. Box 4015, Grand Central Sta., New York, $62.00.

This edition aims to include information on business and property, production figures, subsidiaries and affiliates, capital, dividends, company accounts, and stock exchange listings. Tables are included of petroleum production, oil refining, tanker tonnage, and oil consumption over the world. International professional services and suppliers are listed. Indexes are included. (DLC)

7326 Petroleum requirements. pp 3.96-3.102 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The demand for petroleum products by major categories is presented graphically along with plots showing per capita use of oil products in the US from 1945 through 1975, and important trends in aviation fuels which were set during the period 1965 through 1971. Other data are tabulated on domestic petroleum products demand by uses, factors affecting domestic demand for petroleum products, and domestic gasoline demand during the period 1946 through 1975. (JRD)

RESERVES

REFER ALSO TO CITATION(S) 8417

7327 Endangered balance. Stahmer study points out the natural limits of oil reserves. Stahmer, A.M. *Oel;* **16**: No. 6, 150-155(Jun 1978). (In German).

Since we have to accept the fact that new oil sources are discovered at a diminishing rate and, further, that the pace of production is set by the nature and characteristics of the deposits themselves, the world's oil supply may be considered assured only as long as the ratio of production versus reserves amounts to something like 1 to 20. Sooner or later the demand will have to fit in with the limits thus given.

7328 Marine kerogen and bitumen as energy resources. Tang, J.I.S.; Yen, T.F. (Univ. of Southern California, Los Angeles). pp 174-178 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Marine sediments are naturally-abundant alternative energy resources. Kerogen and bitumen are the major organic substances under consideration here. Marine kerogens comprise the major portion of organic matter in sediment. These kerogens can be converted to gas, oil, bitumen, or resin with the amount of gas or oil produced depending upon the type of kerogen. Bitumen, however, is converted primarily to oil. According to the proposed methods discussed, dikes would be formed by disposing dredged sediments at spoil banks and fenced using an asphalt-based material. The fermentation reaction, under the anaerobic conditions produced by covering with gravel and sand, would yield methane for inland or coastal zone use. The recovery of bitumen from bituminous shales, natural seeps, or tar sands would be accomplished through cold water extraction. Enzymatic reactions followed by the flotation process would recover the oil or gas from marine kerogen. However, in situ ozone oxidation is recommended prior to enzymatic treatment, otherwise the recovery of kerogen is relatively difficult.

7329 Petroleum reserves in Canada. pp 3.73-3.77 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Data and information are presented on proved and probable crude oil reserves in Canada, production of crude oil in Canada, crude oil reserves attributable to pressure maintenance, and original crude-oil-in-place by geological age. The latest data in most cases are for 1974. (JRD)

7330 World petroleum production and reserves. pp 3.78-3.95 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Data on petroleum production and reserves are tabulated and presented graphically. Information and data are included on oil production during 1960 through 1972, cumulative oil production by major producing countries during 1960 through 1972, annual oil production by country from 1960 through 1972, proved recoverable

reserves of crude oil in 1972, production and exploratory wells completed in 1971, and worldwide ultimate recoverable crude oil resources. (JRD)

7331 Petroleum production and reserves in the United States. pp 3.45-3.72 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

A survey of petroleum reserves and production in the US are presented. Most data are as of 1974. Included are petroleum reserve statistics and geological information on oil occurrence. Petroleum production statistics are also included along with definitions of petroleum terms. (JRD)

GEOLOGY AND EXPLORATION

REFER ALSO TO CITATION(S) 7423

7332 Water-soluble radium in brines as indication of the oil-gas capacity of the Pripyat depression. Bogomolov, G.V.; Gribik, Ya.G. (Int. of Geochemistry and Geophysics, Minsk). *Dokl. Akad. Nauk BSSR;* **22**: No. 7, 637-639(Jul 1978). (In Russian).

The content of radium in underground waters of Devonian complexes of the Pripyat depression as an indicator of oil deposits is described.

7333 Exploratory oil wells of North Carolina 1925—1976. Coffey, J.C. (comp.). Raleigh, NC; Department of Natural and Economic Resources (1977). 55p. Department of Natural and Economic Resources, P.O. Box 27687, Raleigh, North Carolina 27611, $12.00.

This publication is a compilation of information pertinent to exploratory oil wells and to the regulations governing oil and gas exploration in North Carolina. Data on each well includes API number, well name, company, chronological number, completion date, basement depth, total depth, location, availability of driller's cuttings and logs, and type of geophysical logs, if any. The well data are arranged alphabetically by counties and chronologically within each county. The wells have been plotted on county highway maps to aid in their location. The appendices consist of a list of geophysical logs available from the Geology and Mineral Resources Section, the oil and gas regulations for the State of North Carolina, and examples of permit forms. A map of eastern North Carolina on which all the exploratory oil wells have been plotted is included.

DRILLING AND PRODUCTION

REFER ALSO TO CITATION(S) 7330, 7628, 9005

7334 System for decreasing resistance to flow of crude oil up from a well or through a pipeline. Allen, J.C.; Chien, S.F. (to Texaco Inc.). US Patent 4,100,967. 18 Jul 1978. Filed date 16 Aug 1976. 10p.

Mechanisms are disclosed comprising means for mixing only water with crude oil at temperatures above 32°F until the inversion point is crossed where a lower viscosity emulsion consisting of oil-in-water is formed for reducing resistance to flow of crude oil up from deep in a well to the surface, or through a pipeline. This oil-in-water emulsion consists of, by volume, 5 percent to 15 percent oil and 95 percent to 85 percent water, respectively.

7335 Oil recovery process using an emulsion slug with tapered surfactant concentration. Bousaid, I.S. (to Texaco Inc.). US Patent 4,100,966. 18 Jul 1978. Filed date 20 Sep 1976. 10p.

A process for recovering oil from a subterranean reservoir is described in which a slug comprising a hydrocarbon-in-water emulsion together with a small amount of surfactant injected into the formation via an injection well is forced through the formation and oil is recovered via a production well penetrating the formation. In this process an emulsion slug is employed in which the surfactant concentration is tapered by increasing the concentration of the surfactant either incrementally, gradually or by any other convenient method during the slug injection time.

7336 Method of improving injectivity profiles and/or vertical conformance in heterogeneous formations. Argabright, P.A.; Rhudy, J.S.; Phillips, B.L. (to Marathon Oil Co.). US Patent 4,098,337. 4 Jul 1978. Filed date 1 Jul 1977. 6p.

Improved injectivity profiles and/or vertical conformance in flooding heterogeneous formations containing high permeability zones is obtained by injecting an aqueous polyacrylamide solution and an aqueous formaldehyde solution into the formation and allowing the polyacrylamide to react with the formaldehyde in the relatively high permeability zones to form a gel. Thereafter, improved sweep efficiency is realized in displacing hydrocarbon from the lesser permeability zones.

7337 Selection of solvents for chemical cleaning of heat exchangers in petroleum preparation installations at oil fields. Mamedov, I.A.; Nasmieva, B.M.; Agaev, A.S. (Nakhichevan Pedagog Inst im. Yu.G. Mamedalieva, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 1, 55-58(1978). (In Russian).

Experimental data on the solvability of untreated deposits, taken from heat exchanger tube space, in water, 0.5 and 1.0% aqueous solutions of "disolvane", benzine, ligroin, kerosene, solar oil, as well as in a 12% solution of inhibited hydrochloric acid are presented. Results of the application of surface-active substances as corrosion inhibitors are presented. It is found that solvability of the organic part of deposits in benzine, ligroin or kerosene is about the same; each of these products may be used for removing the organic part of the deposits in heat exchangers. Gas condensate from well gas separators may be used for this purpose as well. The SU-4 (0.5 g/l) inhibitor may be used as an anticorrosion agent.

7338 Drilling and production. pp 3.103-3.146 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The origin of petroleum is briefly reviewed. Other information is included on drilling and well servicing structures, drilling geometry, gas drilling, geopressured drilling, well control, drilling optimization, rotary drilling, well completion, water control, acidizing, hydraulic fracturing, and enhanced recovery. (JRD)

PROCESSING

REFER ALSO TO CITATION(S) 7589

7339 (CONF-771175—, pp 7.4.1-7.4.8) **Effect of the use of methanol as engine fuel on the refinery process schemes.** Pecci, G.; Garibaldi, P. (Snamprogetti, S.p.A., Milan). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The use of methanol as high octane component of engine fuel requires a reconsideration of the formulation of the present hydrocarbon refining streams. A study has been accomplished, based on a mathematic refinery model, of optimizing the production of premium fuel using the most common refining schemes currently employed in Italy. The composition and characteristics of the fuels relative to each scheme have been established. A blending study has followed in order to determine the concentration of methanol required for the production of premium fuels having a RON of 98-99, no volatility limits, Pb between zero and 0.40 g/l, maximum allowed vapor pressure, complete miscibility at least in the anhydrous state. The effect of the imposition of the volatility limits of the present commercial gasolines on the production of the finished blends has also been considered.

7340 Catalytic cracking process with CO_2-stripped regenerated catalyst. Waghorne, R.H. (to Exxon Research and Engineering Co.). US Patent 4,098,677. 4 Jul 1978. Filed date 22 Mar 1977. 6p.

A catalytic cracking process is provided in which entrained nitrogen is stripped from the regenerated cracking catalyst with a stripping gas comprising at least about 80 mole percent of carbon dioxide prior to contacting the hydrocarbonaceous feed with the regenerated catalyst.

7341 Synthetic halloysites as hydrocarbon conversion catalysts. Robson, H.E. (to Exxon Research and Engineering Co.). US Patent 4,098,676. 4 Jul 1978. Filed date 11 Nov 1976. 8p.

A synthetic halloysite which is substantially iron-free is obtained by crystallization from a reaction mixture containing hydrous alumina gel and aqueous silica sol. Metal substituted synthetic halloysites can be prepared by coprecipitation of metal hydroxides with the alumina gel. Hydrocarbons are converted over cracking catalysts derived from these halloysites.

7342 Petroleum refining and processing. pp 3.225-3.250 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Flowsheets for a typical petroleum refinery are presented. Information is included on crude oil distillation, catalytic cracking, and trends in petroleum processing. (JRD)

7343 Hydrodesulfurization of petroleum crude oil fractions and petroleum products. Hastings, K.H.; Van Driesen, R.P. (Cities Service Research and Development Co., Cranbury, NJ). pp 3.251-3.264 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Sulfur removal as practiced in petroleum refineries can take the form of chemical removal (acid treating or sweetening), concentration in refinery products (high sulfur coke), or

hydrodesulfurization. A description is presented to review how hydrodesulfurization is used to remove sulfur compounds from petroleum crude oils or fractions, and to comment on how molecular structure and organometals content affect sulfur removal. Sulfur removal is practiced in petroleum refineries for four reasons: Sulfur compounds (1) lower the quality of some refinery products, (2) pollute the atmosphere as sulfur oxides when they are burned, (3) corrode refinery process equipment, and (4) poison the catalysts used in some refinery processes. Hydrodesulfurization is a catalytic process whereby a hydrocarbon feedstock and hydrogen are passed through a catalyst bed at elevated temperatures and pressures. Some of the sulfur atoms attached to hydrocarbon molecules react with hydrogen on the surface of the catalyst to form hydrogen sulfide. Thermodynamic equilibrium calculations show that these reactions could be driven to almost 100 percent completion, but economic considerations normally limit the commercial application of hydrodesulfurization.

7344 Total energy concept in refinery and process plant planning. Klooster, H.J. (Fluor Engineers and Constructors, Inc., Los Angeles). pp 3.272-3.303 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Traditional and new methods for energy conservation in refinery and process plant planning are evaluated. Information is included on integrated systems analysis, energy utilization and conservation, recovery of waste heat, and conservation of electricity. (JRD)

PRODUCTS AND BY-PRODUCTS

REFER ALSO TO CITATION(S) 8358

7345 (CONF-771175—, pp 7.2.1-7.2.7) **Methanol in motor gasoline: impact on oil refining.** Spencer, E.H. (PB Trading Ltd., Sunbury-on-Thames, Eng.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The effects on oil refinery operations of blending methanol into motor gasoline are considered in hydroskimming and catalytic cracking refineries. When methanol is included a greater production of gasoline is possible, with significant improvements in quality. Alternatively, with constant gasoline production, crude consumption is reduced. Catalytic reformer throughput and operating severity are reduced. Some reformation is necessary, mainly to overcome the increase in volatility. RON and RON/sub 100°C/ are increased while benzene content and MON are decreased. Although the methanol blends considered meet the normal quality specifications, it should be noted that no account has been taken of the problems of water tolerance, increased fuel consumption and changes of specification which may be necessary to ensure adequate road performance. Economics are not considered.

7346 Systems approach to assessing new petrochemical technology. Stadtherr, M.A. (Univ. of Illinois, Urbana). *Chem. Eng. Sci.;* **33**: No. 7, 921-922(1978).

Using a systems model of the petrochemical industry, it is shown that new petrochemical processes are more likely candidates for success if their introduction would result in better resource use by the industry as a whole. This principle is then used to estimate the relative probability of success for four recently developed processes. Such studies may be useful in modeling the long-range development of the industry and may assist the industry in setting long-range research and development goals.

7347 Saving costs with the fire whip. *Betriebstechnik;* **18**: No. 6, 29-30, 32(1977). (In German).

Additives added to heavy heating oil in a mixing ratio of 1 to 1000 to 4000 prevent the formation of slurries in the tank which can often lead to operational accidents, and furthermore lead to improved combustion as for light heating oil and thus to a higher efficiency. The contribution investigates the effect and seriousness of these market boosted addition products mostly termed as fire whips.

7348 Study of process petroleum pitch carbonization and properties of pitch-derived graphites. Tsarev, V.Ya.; Drovetskaya, L.A.; Lapina, N.A.; Dolmatov, L.V. *Khim. Tverd. Topl.;* No. 2, 98-101(1977). (In Russian).

A comparative study was made of three petroleum-derived pitch products used as binders for the production of carbon materials. The pitch from the heavy pyrolysis tar of the Ufim Synthetic Alcohol Plant exhibited the best properties. 1 diagram, 3 tables, 14 references.

7349 Petrochemical complex. pp 3.265-3.271 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

A petrochemical complex is described. The term applies to an assortment of aggregated processing units which are engaged in the conversion of several raw materials derived from petroleum into a variety of petrochemical intermediates or final products. Information is included on classes of petrochemicals and interdependence of plants and material resources. A flowsheet for a petrochemical complex is included. (JRD)

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7353

7350 Rotating blowout preventer apparatus. Lewis, G.E. (to Hydril Co.). US Patent 4,098,341. 4 Jul 1978. Filed date 28 Feb 1977. 16p.

Rotary blowout preventer apparatus includes: (a) an upright tubular body adapted to receive an annular packer to be constricted about a rotating well element, (b) and a rotary annular assembly carried in the body to rotate relative thereto and with the packer when the packer is constricted about said rotating element, said assembly including an actuator movable in the body to effect said constriction of the packer, (c) said assembly also including an annular head member having a shoulder located to receive vertical thrust exerted by the packer when the actuator effects constriction thereof.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 8418, 8419

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 7269, 8884

7351 (DOE/EV—0015, pp 39-49) **Petroleum and gas.** Jun 1978.

In Division of Environmental Control Technology program, 1977.

Sixteen DOE-sponsored projects on various aspects of oil spills and LNG spills are briefly described. (LK)

7352 Largest oil spills: inconsistencies, information gaps. Butler, J.N. *Ocean Ind.;* **13**: No. 10, 101-102, 105-106, 108, 110(Oct 1978).

This paper is a review of 35 of the largest oil spills from 1942 to 1978. The sources of information on these spills are discussed. The need for a systematic, uniform worldwide reporting scheme for tanker accidents and other pollution incidents, especially those occurring on the high seas, is pointed out. 52 references. (DLC)

7353 Oil disasters due to tanker accidents. Gierloff-Emden, H.G. (Muenchen Univ. (Germany, F.R.). Lehrstuhl fuer Geographie und Geographische Fernerkundung); Guilcher, A. (Brest Univ., 29 (France). Section Geographie). *Umsch. Wiss. Tech.;* **78**: No. 15, 468-475(Aug 1978). (In German).

Oil pollution of oceans is an impact of our environment. This pollution is partly caused by oiltankers. Catastrophes on the oceans caused by tankers are more severe when the so-called 'supertankers' are involved. There is a lack of strict restrictions concerning the safety of shipbuilding and the navigation of those tankers by the conventions. Two times the coast of the Bretagne in France was severely hit by tanker-catastrophes, in 1967 by the 'Torrey Canyon', and in 1978 by the 'Amoco Cadiz'. The impacts are not only the ones of short time: It will take years to forget the damage on the ecology and the environment.

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 8412, 8419

7354 (DES—76-1) **Mandatory Canadian crude oil allocation regulations.** (Federal Energy Administration, Washington, DC (USA)). 12 Mar 1976. 392p. Dep. NTIS, PC A17/MF A01.

The Canadian Government has announced its intention to reduce the amount of crude oil exported to the United States. On January 28, 1976 the Federal Energy Administration (FEA) announced regulations to allocate diminishing amounts of Canadian crude oil deliveries during the period of 1976 through 1981. Cases I

and II are different ways of applying the Regulations. First and second priorities are distinctions between refineries, that determine their preferential allocation under the program defined by the Regulations. This program will alter the distribution of supplies of crude oil, during an interim period 1976 to 1981, which Canada would have delivered to specific American refineries if no FEA action were taken. Under the allocation rules, certain refineries are designated first priority for the purpose of providing them with preferential allocation. Under Case 1, application of the Regulations, the major impacts would be an increase of spill risk in the Puget Sound, from 1976 through 1979, by 1^{5} to 2^{5} in excess of the risk that would be present without FEA action. Also, there may be an increase in sulfur received from alternative sources, posing problems of compliance with air quality standards. Under Case 1, regions other than Puget Sound, containing second priority users, will largely experience an insignificant degree of environmental impact as a result of the Regulations, in terms of air pollution or risk of spill. Under Case II there are no significant environmental impacts resulting from the application of the Regulations.

TRANSPORT, PIPELINES, AND HANDLING

REFER ALSO TO CITATION(S) 7334, 7413, 8400

7355 Function of the welding technique in connection with the construction of the Trans Alaska Oil Pipeline. Dittrich, S. (Westfaelische Union A.G., Hamm (Germany, F.R.)). *Erdoel-Erdgas Z.;* **94**: No. 2, 44-49(Feb 1978). (In German).

The article describes the selection of the pipe material, the welding technique and the welding electrodes as well as the Schnadt-Fisco weldability test, the determination of the welding parameters, and the testing of the welded joints. It is found that the conventional pipeline construction technique i.e. vertical-down welding with cellulose electrodes, yields absolutely reliable results even under extreme conditions if the right pipe material and the right auxiliary materials are used.

7356 Evolution of petroleum pipelines in the United States. pp 3.174-3.175 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Statistics as they relate historically to pipelines for petroleum and related products are given. The information covers the period 1900 to 1919, the period 1920 to 1928, the period 1929 to 1941, the World War II years, and the period 1962 to 1972. (JRD)

7357 Railroad transportation of liquid and gaseous fuels. pp 3.176-3.195 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Fuel transportation in the US by rail is reviewed. Evolution of the tank car is discussed and information is given on gaseous and liquid fuel movements, specifications for tankcars, loading and unloading tankcars, and tankcar procurement. A brief discussion of the rail situation in Europe is included. (JRD)

7358 Seagoing vessels for transporting liquid and gaseous fuels. Szostak, D.J.; Baldwin, P.B. (Marketing, Marine Transport Lines, Inc., New York). pp 3.196-3.206 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Ocean transport of fuels is reviewed. Technical and business considerations in operating and leasing vessels are discussed and a classification of tanker ships is given. Definitions of terms associated with fuel shipping are included. (JRD)

7359 Superports. Posthuma, F. (Rotteerdam-Europoort). pp 3.207-3.224 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

A superport is defined as a port that can accommodate carriers of 200,000 deadweight tonnage and greater. The minimum draft of such ships when fully loaded is 60 ft. Tankers of 60 ft and over in service or on order in 1974 are tabulated. Information is included on related ship and port criteria, design criteria for superports, maneuverability of very large crude carriers, and building of a superport. (JRD)

7360 Posledovatel'naya perekachka neftei i nefteproduktov po magistral'nym truboprovodam. (Successive transfer of petroleum and petroleum products in pipe mains). Nechval, M.V.; Novoselov, V.F.; Tugunov, P.I. Moscow; Nedra (1976). 224p.

A study is made of basic problems associated with the theory and practice of the successive transfer of petroleum and petroleum products along pipe mains. An examination is made of successive transfer technology, and a presentation is made of the theoretical basis of mixture formation, features of successive transfer of petroleum products which significantly differ in physico-chemical properties, and mixture formation under non-isothermal conditions. An analysis is made of various factors which influence an increase in mixture volume, and recommendations are made for selecting operational procedures for pumping stations. An examination is made of problems in the design and use of pipelines for successive transfer. A description is given of modern methods of estimating, receiving and distributing blends, control instruments for advancing the blend zone and devices for distributing blends to the reservoirs. The book is intended for engineering-technical personnel engaged in the design and operation of main petroleum product pipelines. It can also be used by specialists engaged in the transportation of petroleum and petroleum products. 6 tables, 67 illustrations, 98 references.

PROPERTIES

7361 Source rock: crude oil correlation by isotopic type-curves. Strahl, W.J. (Federal Inst. for Geosciences and Natural Resources, Hannover). *Geochim. Cosmochim. Acta;* **42**: No. 10, 1573-1577(Oct 1978).

An isotopic type-curve has been defined based on the $^{13}C/^{12}C$ ratios of the saturated, aromatic, heterocomponent (NOSs), and asphaltene fractions of crude oils. These fractions show ^{13}C enrichments with increasing polarity or polarizability. This systematic pattern can be used to estimate the $^{13}C/^{12}C$ ratio of the kerogen from which the oil had been generated. Genetically associated source rock oil pairs have been used to show that the difference between the measured and the estimated delta-values of kerogen is about -0.5 ‰ and between the delta-values of the kerogen and the asphaltene fraction is approximately +0.6 ‰.

7362 Petroleum. Thornton, D.P. Jr. (Universal Oil Products Co., Des Plaines, IL). pp 3.12-3.21 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

A review of petroleum technology is presented. Petroleum is defined and its basic classes are summarized. The significance of petroleum composition is discussed and petroleum components are tabulated. The derivation and uses of major petroleum products are listed. (JRD)

7363 Petroleum fuels characteristics. pp 3.22-3.44 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Four major petroleum fuels are described including motor gasolines, diesel fuels, aviation turbine fuels, and oil fuels for burners. Data and information are included on gasoline octane numbers, vapor pressures, distillation temperature, antiknock qualities, additives, and volatility. Properties of diesel fuels, aviation fuels, and burner oil fuels are presented tabularly and graphically and discussed. (JRD)

COMBUSTION

REFER ALSO TO CITATION(S) 7347, 8438

NATURAL GAS

REFER ALSO TO CITATION(S) 7325

7364 Future gas consumption of the United States. Doran, R.K. (Univ. of Denver). pp 2.47-2.59 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Estimated gas consumption in the US during the years 1975 through 1985 is tabulated. The data are presented as related to class of service and by region. Data and information are included on supplemental gas sources. (JRD)

RESERVES

REFER ALSO TO CITATION(S) 7328, 8417

7365 Natural gas production and reserves in the United States. pp 2.9-2.19 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Data and information are presented on the natural gas in the USA. Numerical data on the proved reserves are tabulated by state. Other data are tabulated on estimated ultimate recovery, on estimated total proved reserves of natural gas liquids, and on estimated daily productive capacity of natural gas and natural gas liquids. (JRD)

7366 Potential supply of natural gas in the United States. Rassinier, E.A.; Glover, P.N. (Colorado School of Mines Foundation,

Inc., Golden). pp 2.20-2.33 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Highlights of the Potential Gas Committee Report issued in November 1973, reflecting the potential supply of natural gas in the USA as of December 31, 1972, are summarized. The data are reported for eleven geographic areas. The total as of December 31, 1972, is estimated at 1146 trillion ft^3. (JRD)

7367 Natural gas reserves in Canada. pp 2.34-2.37 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Reserves of natural gas and natural gas liquids are tabulated. Other data on proved and probable reserves are presented in graphs for the years 1954 through 1974. Data on production for the years 1955 through 1974 are also presented in graphs. Definitions of terms are included. (JRD)

7368 World natural gas production and reserves. pp 2.38-2.46 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The annual worldwide natural gas production from 1960 through 1972 is tabulated by country. Proved worldwide natural gas reserves as of 1972 are also tabulated by country. The ultimate recoverable worldwide natural gas resources are tabulated by numbered categories for each country. (JRD)

GEOLOGY AND EXPLORATION

REFER ALSO TO CITATION(S) 7333, 7415, 7423, 7424, 8421

7369 (METC/SP—78/6(Vol.1), pp 196-205) **Lineaments and ground-water quality as exploration tools for ground water and gas in the Cottageville area of western West Virginia.** Jones, D.S.; Rauch, H.W. Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

As part of a hydrogeologic study of west-central Jackson County, lineaments were mapped and water wells were characterized for physical and chemical parameters, especially in the Cottageville area. Short straight photolineaments are significantly associated with water well yields in gallons per minute, with wells closer than 100 feet having higher yields. Such lineaments act as anomalous zones about 200 feet in width with respect to water wells. Short photolineaments are not in general associated with gas well yield, but gas wells located within 0.5 miles of a short photolineament bearing N 60°W—N90°W (WNW) yield at significantly greater rates (as natural initial open flow) than wells near other photolineaments. The density of WNW photolineaments is also significantly and directly associated with gas well yield. Water well yield has no relationship to Landsat or curvilinear lineaments. However, gas wells located within 0.25 miles of one Landsat lineament or within 0.5 miles of a curvilinear lineament over one mile long yield at significantly lower rates. High concentrations of nitrate and sulfate, and especially of bicarbonate and total hardness in shallow ground water are significantly associated with high expected (interpolated) gas well yield. Tentative conclusions from sparce data indicate that gas well yield will be significantly higher when gas wells are located in areas having ground-water concentrations exceeding 500 mg/l, 250 mg/l, 13 mg/l, and 34 mg/l for bicarbonate, total hardness, nitrate, and sulfate, respectively. In summary, short photolineaments make a good exploration tool for locating water wells; both WNW photolineament density and ground water quality may serve new exploration techniques for Devonian shale gas in the Cottageville, but Landsat and curvilinear lineaments should be avoided.

7370 (METC/SP—78/6(Vol.1), pp 207-218) **Preliminary assessment of the applicability of hot-wire gas-detection units to exploration and development of Devonian shale gas resources.** Majchszak, F.L. Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium preprints.

Present projectwide resource-inventory efforts are directed at defining the stratigraphy of the Devonian shales on the basis of borehole geophysical log interpretation, chiefly gamma ray log response. This approach involves the basic premises that high gamma ray log responses represent dark-colored organic-rich shales and that rocks of this type are the preferred targets for exploration. Deployment of hot-wire gas-detection units at selected drilling locations and collection and interpretation of sample suites from these wells places the Ohio Division of Geological Survey in the unique position of being able to test the validity of these assumptions. Although useful in exploration, previous information about gas shows in the Devonian shales necessarily is based upon drillers' records supplemented by scattered wireline temperature surveys. Because small shows of gas in the Devonian shales are assumed by drillers to be ubiquitous, countless gas shows go unreported. As a result, the geographic distribution of reported shows may not be representative. Gas-show profiles are fairly consistent and semiquantitative in nature and can be used to identify potential producing horizons, such as siltstone units interbedded in Devonian shales of "normal" radioactivity, that are not characterized by high gamma ray log responses. Gas-detector information also can be used to design or modify completion programs in order to concentrate well-stimulation efforts on zones of greatest apparent potential. Proper integration of gas-detector information with other established geologic and engineering techniques will greatly facilitate exploration for and development of Devonian shale gas resources.

7371 (METC/SP—78/6(Vol.1), pp 219-229) **Comparison of the New Albany Shale from deep and shallow parts of the Illinois Basin in Indiana.** Shaffer, N.R.; Bassett, J.L.; Carr, D.D.; Chen, P.Y.; Hasenmueller, N.R.; Lechler, P.J.; Leininger, R.K. Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Chemical, physical, and lithologic characteristics of samples from three cores of the New Albany Shale (Devonian-Mississippian) in the eastern part of the Illinois Basin in Indiana have consistent correlations with electrical resistivity and natural gamma radiation as determined from geophysical logs. Concentration of organic carbon, hydrogen, nitrogen, and vanadium show positive correlations with gamma-ray and resistance values, and carbonate carbon, CaO, MgO, MnO, and Sr show negative correlations in the upper part of the New Albany. In the lower part (Blocher Member), however, CaO, MgO, MnO, and Sr show a positive correlation with resistivity. Sulfur, Zn, FeO (total Fe calculated as FeO), Cr, and Cu distributions also correlate positively with gamma-ray and resistance values; likewise, SiO_2, Al_2O_3, K_2O, Na_2O, and Th, correlate positively but less closely and with major discrepancies. The New Albany in the deep part of the Illinois Basin, represented by the core from Sullivan County, is 125 feet thick and consists mainly of dark-gray to black organic-rich shale. The New Albany in the shallow part of the basin, represented by cores from Marion County, is more than 100 feet thick and has a larger proportion of greenish-gray shale, especially in the Sweetland Creek Member, than the Sullivan County core. Styliolina- and Tentaculites-bearing calcareous organic shale zones at the base and near the top of the basal Blocher Member may be good stratigraphic markers in Indiana. Phosphorous, which is enriched in a thin bed near the top of the New Albany at both sites, may be used to indicate the top of the New Albany where the Rockford Limestone is absent.

7372 (METC/SP—78/6(Vol.1), pp 240-250) **Tully Limestone and Hamilton Group in north-central and east-central West Virginia.** Schwietering, J.F.; Neal, D.W.; Dowse, M.E. (West Virginia Geological and Economic Survey, Morgantown). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

In West Virginia, the Tully Limestone occurs only in the northern and central parts of the state, whereas the Hamilton Group is more widely distributed. The restricted distribution of the Tully Limestone relative to the Hamilton Group may be accounted for by facies change in the eastern part of the state, and by either erosion or nondeposition in the western and southern parts of the state. The Tully Limestone is overlain by a highly radioactive shale that is correlated with the Burket Shale. The Tully is underlain by the Hamilton Group. The Hamilton Group, which includes the Mahantango Formation and the Marcellus Shale, rests on limestones and shales of the Onesquethaw Stage.

7373 (METC/SP—78/6(Vol.1), pp 251-263) **Relationship of lineaments to gas production in the New Albany Shale in Indiana.** Bassett, J.L.; Blakely, R.F.; Carr, D.D.; Hasenmueller, N.R.; Powell, R.L. (Indiana Geological Survey, Bloomington). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Investigation of lineament orientation of the Corydon, New Middletown, and Laconia gas fields, three of the larger producing fields from the New Albany Shale in Indiana, found that the distribution of bearings is similar to the distribution of 1,246 lineament angles for all Harrison County and of more than 10,000 lineament angles for all southwestern Indiana underlain by the New Albany Shale. Gas production in the Corydon, New Middletown, and Laconia Fields is related to structural highs as determined from mapping on top of the New Albany Shale, but no strong correlation could be found between lineament alignment and structure orientation. For the Laconia Field, lineaments tended to be oriented almost normal to and at angles of 70-75° to bedrock strike, but for the Corydon and New Middletown Fields, lineaments were more nearly parallel. Gentle folding of the New Albany is believed to have

created fractures in the shale that provided permeability for gas flow through the normally tight shale.

7374 (METC/SP—78/6(Vol.1), pp 303-309) **Preliminary scanning electron microscopic study of organic material in the Devonian eastern gas shale.** Green, D.A.; Lamey, S.C. (Morgantown Energy Technology Center, WV). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

A scanning electron microscope study on eastern Devonian gas bearing shales was conducted to investigate thermal and chemical effects on the organic distribution and changes within the matrix. Shale samples from Perry County, Kentucky were examined by the scanning electron microscope (SEM) and then subjected to solvent extraction and pyrolysis at 300°C under a nitrogen atmosphere. Changes in the shale as a result of these treatments were analyzed by use of an SEM. Selective removal of portions of the organic material by these techniques was observed. The SEM method, together with chemical and thermal treatment, is potentially useful for determining the distribution of the kerogen and bitumen within the shale.

7375 (METC/SP—78/6(Vol.1), pp 310-329) **Stratigraphy, extent, gas production, and future gas potential of the Devonian organic-rich shales in Pennsylvania.** Harper, J.A.; Piotrowski, R.G. (Pennsylvania Geological Survey, Pittsburgh). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

The Devonian gas shales are a sequence of black, organic-rich shales which are the basal units of the Catskill clastic wedge. Interpretation of stratigraphic cross sections indicates three major radioactive black shale units in the subsurface of Pennsylvania. These units are the Upper Devonian Dunkirk and Rhinestreet shales, and the Middle Devonian Marcellus shale. Mapping of these shales indicates three distinct overlapping belts of deposition which trend northeast-southwest. The Marcellus shale belt which is present in the eastern portion of the plateau region of Pennsylvania is the oldest and deepest. Numerous gas shows have been reported from this unit, but gas has not been produced commercially. The Rhinestreet shale belt is present further to the northwest and is younger and shallower than the Marcellus. This unit has produced commercially from wells in Beaver County. The Dunkirk shale belt is present in northwest Pennsylvania along Lake Erie and is the youngest and shallowest unit. Gas production has existed from this unit since the 1800's and several producing wells have recently been drilled in Erie County. Future potential for natural gas production exists in all three major shale units. Due to drilling economics and a long producing history, the Dunkirk shale, which is the shallowest unit, appears to have the most immediate potential, followed by the Rhinestreet shale. The Marcellus shale does not appear to be attractive as a primary target zone due to its depth, but it could be a good secondary drilling objective.

7376 (METC/SP—78/6(Vol.1), pp 360-369) **Porous fracture facies in the Devonian shales of eastern Kentucky and West Virginia.** Shumaker, R.C. (West Virginia Univ., Morgantown). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Preliminary analysis of published fracture data obtained from seven oriented Devonian shale cores taken cooperatively by private industry and the U.S. Department of Energy, Eastern Gas Shales Project shows that fractures are numerous, uniquely oriented, and often mineralized in the highly organic portions of the Devonian shale of eastern Kentucky and West Virginia. These fractures and the commercial gas production generally occur together in the organic shales. The descriptive phrase "porous fracture facies" is applied to succinctly label the fractured and productive shale. Inclined slickensided fractures, found in the West Virginia cores, appear to be double shear sets that have an acute angle which open toward the southeast. This orientation is approximately at right angles to the fold axes, which suggests that the fractures developed during the Alleghenian deformation in response to differential shortening across the lower organic shales. A core taken in Kentucky contained horizontal slickinsides in an upper organic shale. Those slickensides trend parallel to the thrust movement of the adjacent Pine Mountain thrust sheet. Inclined slickensided fractures trending North-South are found in a lower organic shale. Many problems remain, and more detailed analysis is being accomplished. The best of several working hypotheses contends that the fracture facie formed within a zone of abnormally high fluid (gas) pressure located primarily in the lower organic shales. The western limit of abnormal high pressure may have been the basement fault zone along the western margin of the Rome Trough. The eastern limit of commercial production and open fractures appears to be the area of more intense tectonic transport in the area of the detached folds and thrusts.

7377 (METC/SP—78/6(Vol.1), pp 377-395) **Advanced explosive stimulation approach for Devonian shale.** Schott, G.L.; Marsh, S.P.; Mautz, C.W.; Burback, R.L.; Jacobson, J.D.; Carter, W.J. (Los Alamos Scientific Lab., NM). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

As part of the Eastern Gas Shales Project, the Los Alamos Scientific Laboratory is investigating the application of improved shaped charges lined with uranium metal to the open-hole explosive stimulation of gas in tight, carbonaceous shales. Above-ground testing methods for charges having several pounds of explosive were developed and used to determine optimum thickness of uranium liner in hemispherical charges as a reference design. Tests with encased core specimens were made with commercial perforator charges lined with copper cones to intercompare the penetrabilities of synthetic grouts with shales and reference rock types. Advanced charge designs using tapered thickness of the smoothly concave liner to achieve controlled, on-axis collapse and high-performance jets are analyzed by hydrodynamic computer methods, fabricated, and tested by experimental firing. Shock wave Hugoniot data observed in planar impact experiments on Devonian shale core specimens is systematized for future high-pressure penetration dynamics calculations by a theoretical model which includes mechanical unloading hysteresis and is guided by the known behavior of quartz.

7378 (METC/SP—78/6(Vol.1), pp 404-414) **Effects of Pine Mountain overthrust and other regional faults on the stratigraphy and gas occurrence of Devonian shales in Kentucky and Virginia.** Zafar, J.S.; Wilson, E.N. (Univ. of Kentucky, Lexington). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Geologic characterization of the Devonian-Mississippian shales south and east of the Big Sandy Field in Kentucky is difficult because they thin regionally southwestward, thicken southeastward with approach to a source area, and the whole is distorted by compression and possibly lateral movement along the regional overthrusts of Pine Mountain and the Valley-and-Ridge province. A stratigraphic cross-section from the Appalachian Plateau to the Greendale Syncline illustrates the distortions. The similarity of stratigraphy across the Pine Mountain Fault indicates that the shear surface is in the Upper Huron Unit or above. Further southeast, the replacement of the Cleveland, Chagrin, and Upper Huron equivalents by siltstones and silty shales suggests possible crustal shortening or decollement. A gray shale just above the Lower Huron has been traced nearly across the section as a correlatable unit. The stratigraphy of the substrates of the Shales has been affected by tectonism, but the influence, if any, of this tectonism on the stratigraphy of the Shales is very obscure. In the cored well in Wise County, profuse gas bleeding from the Cleveland and Lower Huron low-density shales is reported, whereas only light bleeding of gas from the less carbonaceous higher-density Middle Huron equivalents are reported.

7379 (METC/SP—78/6(Vol.1), pp 416-430) **Detection of interaction effects. A report on a statistical technique for the selection of optimal variables among the characterization data.** Kalyoncu, R.S.; Spinosa, E.D.; Hooie, D.T.; Snyder, M.J. (Battelle Columbus Labs., OH). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

A statistical technique Automatic Interaction Detection (AID) is described. The technique is very useful in studying the interrelationships among a number of variables (obtained from undersigned experiment). Regarding one of the variables as a criterion (dependent) variable, the analysis employs a branching process based on variance analysis techniques to divide the sample into a series of subgroups which maximize the ability to predict values of the criterion variable. Linearity and additivity assumptions inherent to conventional multiple regression techniques are not required in the technique. AID is designed to analyze and determine the interrelationships among the variables in survey data under which the characterization data of Eastern Gas Shales fall. Although preliminary in nature, the initial AID run on the available characterization data has revealed some interesting relationships between laboratory and wire-line log data and their relationship to hydrocarbon gases in the shales. These correlations may lead to accurate prediction of potential hydrocarbon gas contents in the Eastern Shale Deposits.

7380 (METC/SP—78/6(Vol.1), pp 444-454) **Stratigraphic relationships of the New Albany Shale Group (Devonian—Mississippian) in Illinois.** Reinbold, M.L. (Illinois State Univ., Urbana). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

The New Albany Shale Group and closely related, adjacent strata in the Illinois Basin can be classed into five main lithologies: black or brownish black shale; gray to greenish gray shale; calcareous or dolomitic shale; siltstone; and limestone. Detailed stratigraphic correlations based on cores, geophysical logs, and sample studies indicate that these lithologies grade vertically and laterally into one another, with complex intertonguing relationships. In this report, these relationships are illustrated by a long northwest-southeast cross section. Facies distribution of the New Albany suggests that these strata were deposited in a stratified anoxic basin. Black shales, which reflect anoxic conditions, predominate near the center of the basin; these shales probably represent the deepest water environments. Olive, gray, and greenish gray shales predominate in basin flank areas; these lithologies indicate low to moderate oxygenation and probably shallower water environments. Limestones, which are thickest in marginal areas of the basin, probably were deposited in shallow, well-oxygenated water.

DRILLING, PRODUCTION, AND PROCESSING

REFER ALSO TO CITATION(S) 7590, 7628

7381 (METC/SP—78/6(Vol.1), pp 370-376) **Implication of specific degasibility for models of gas production from shale.** Schettler, P.D. Jr. (Juniata College, Huntingdon, PA). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Estimations of the potential of Devonian shales for gas production depends upon an accurate model. Wrong models give wrong results; specifically the current crop of wrong models underestimates the productivity of the reservoir by factors of 1000 or more. Two bad conceptualizations include, first, the use of open porosity for estimation of gas content and, second, the use of Darcy's law models applied to the shale fracture system that do not specifically take account of diffusion of gas into the fractures through its walls. Both of these models neglect primary processes involved in shale well production and as such greatly underestimate the capacity of these wells to produce.

7382 (NP—23387) **Opportunities for increasing natural gas production in the near term. Volume II. East Cameron Block 64 field.** (National Academy of Sciences, Washington, DC (USA)). 1977. 93p. National Academy of Sciences, Washington, DC.

Interim report to the U.S. Department of the Interior.

No opportunity exists for increasing the rate of production of natural gas from the East Cameron Block 64 field. Only a limited opportunity exists for temporarily arresting an established decline in production. The remaining volume of economically recoverable gas in the East Cameron Block 64 field is estimated to be in the range of 120 to 198 Bcf with a most likely value of 160 Bcf. Accelerating production from given reserves in the near term shortens field life. Even where physical factors are favorable, there are social, legal, regulatory, and economic issues that may be barriers to accelerating production.

7383 **Economic limits of gas field operations.** Gandkin, V.Ya.; Charuiskaya, L.A. *Gazov. Prom-st.;* No. 7, 12-15(Jul 1977). (In Russian).

The basic methodological conditions are given for determining the economic limits for the profitable operation of gas wells and fields. Substantiation is given for the criterion of calculating the limits of profitably operating these fields and individual wells from national economic viewpoints. 1 table, 3 references.

7384 **Use of an ejector in a low temperature separation system.** Tsarev, I.N.; Solov'ev, O.N.; Shikhov, E.M.; Repin, E.A. *Gazov. Prom-st.;* No. 7, 16-18(Jul 1977). (In Russian).

Results are cited for introducing an ejector in a device for the low-temperature separation of gas at the Vuktyl Gas Condensate Field. This has made it possible to draw in additional quantities of degassed condensate gas and improve the condensate's qualtiy by means of separation in a negative temperature.

7385 **System for the optimal automatic control of gas well production.** Taranenko, B.F. *Gazov. Prom-st.;* No. 7, 21-24(Jul 1977). (In Russian).

A formulation is given for the problem of optimal production distribution of a gas collection point among wells operating on a common collector. A mathematical model of the problem and a graphic-analytical method for solving that problem are presented. Shortcomings are noted in the use of a computer for solving the problem within the framework of an automatic heat flow control system. A fundamental arrangement is presented for an automatic control cascade system with stopping devices in the feedback chain which effectuates the problem of optimal control. 3 illustrations.

7386 **Analysis of the low-temperature separation process at the Orenburg Field.** Gritsenko, A.I.; Murin, V.I.; Galanin, I.A.; Shatalov, A.T. *Gazov. Prom-st.;* No. 7, 25-27(Jul 1977). (In Russian).

Factual material is presented on the analysis of heat balance in low-temperature separation devices at the Orenburg Gas Condensate Field. The maintenance of high underrecuperation temperatures was shown to lead to a rise in the separation temperature. The heat balance of low-temperature separation devices is analyzed, and recommendations are subsequently made for improving the technology of industrial gas processing. 1 table, 3 illustrations.

7387 **Separation of helium from natural gas by diffusion.** Nikitina, I.E.; Ismailova, Kh.I. *Gazov. Prom-st.;* No. 7, 32-33(Jul 1977). (In Russian).

A computation analysis is made of technological and technical-economic factors in the separation of helium from natural gas by diffusion. The promising films for this purpose are identified, and evaluations are made of surface membranes, power required for the process, product composition, capital, operational and cited expenditures. 2 tables, 2 references.

7388 **Cryogenic upgrading of low-Btu gases.** Jones, J.K. (ChemShare Process Systems Ltd., London). pp 2.116-2.119 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The cryogenic upgrading of low-Btu gas to produce a high-heating-value product results in: (1) the gas being more readily utilized; (2) the elimination of impurities which improves (a) the gas-burning characteristics and (b) the transport properties (high-Btu gas will have a lower density and viscosity than low-Btu gas), resulting in less horsepower and compression equipment for transmission; (3) increased thermal delivery of pipelines previously transporting low-Btu gases, or smaller pipe diameter for a required thermal delivery; (4) allowance for the extraction of heavier hydrocarbons and natural gas liquids; and (5) higher hydrocarbon partial pressures when the gas is used in chemical reactions. Cryogenic upgrading plants can be designed (1) to accept a wide variation of gas composition and flow rate; (2) to produe a controlled, high-heating-value product (1000 Btu/standard cubic foot) with a high hydrocarbon recovery (up to 99%); (3) to recover natural gas liquids as an integral part of the process; (4) to produce liquefied natural gas (LNG) for peak shaving or for distribution to satellite stations and beyond-the-mains service; and (5) to produce liquid cryogens, such as liquid nitrogen.

7389 **Absorption of acidic gases from natural gas and SNG.** Fisch, E.J.; Hill, E.S.; Van Scoy, R.W. (Shell Oil Co., Houston, TX). pp 2.133-2.136 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Absorption processes used in sweetening natural gas containing sulfur compounds are described with emphasis on the Sulfinol process. The range of applications of the Sulfinol process is discussed along with process principles. (JRD)

PRODUCTS AND BY-PRODUCTS

REFER ALSO TO CITATION(S) 7625

7390 **Chemical feedstocks from natural gas.** pp 2.129-2.132 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Processes for recovery of hydrocarbons from natural gas are described. Information and flowsheets are included on the absorption-oil process and the cryogenic process. Ammonia, hydrogen, and methanol are among the products of these processes. (JRD)

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7350

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 7383

7391 (DOE/FERC—0021) **Commission staff report.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Pipeline and Producer Regulation). May 1978. 420p. Dep. NTIS, PC A18/MF A01.

For three consecutive years beginning in April, 1975, the Federal Energy Administration (FEA) and the Federal Power Commission (FPC), in their respective jurisdictions, annually mailed FEA Form G-101 and FPC Form 69 to natural gas distributors who deliver gas to end-use customers. These distributors are required by

law to report on these forms natural gas deliveries to end-use customers by type of service (firm or interruptible), type of customer [Standard Industrial Classification (SIC) codes] and by state. Natural gas curtailment and type of alternate fuels that customers use in replacing curtailed natural gas are also required to be reported. Beginning April, 1978 this data collection will be made by the U.S. Department of Energy's Energy Information Administration using EIA Form 50. Accumulated actual data extends from April, 1974 to March, 1977; this is supplemented by projected data for April, 1977 through March, 1978 as reported in the 1977 survey. The thirty-six months of actual data are not of uniform quality or quantity. The first twelve months of actual data were never completely audited due to the wide-spread variation in the volume units of alternate fuels reported by different distributors. Also, only curtailed large end-users were reported in the first two years, but the third year actual and projected data includes curtailed and not-curtailed large end-users. This report concerns the Schedule 1 data from FEA Form G-101 and FPC Form 69 [that is, large-volume (100 million cubic feet combined natural gas deliveries and curtailment in an actual year) end-user data]. The data have been aggregated in various ways and displayed in graphical and tabular form. The graphical form includes three-dimensional maps showing the geographical distribution of fuel volumes.

7392 Determining the need for gas transfer aggregates in future planning. Kiseleva, V.A.; Chernyak, E.Yu.; Bitkova, N.A.; Ryvlin, S.Sh.; Zaborin, V.I. *Gazov. Prom-st.;* No. 7, 41-45(Jul 1977). (In Russian).

A discussion is made of determining the need of gas transfer aggregates in the gas industry on the basis of scientifically designed enlarged standards. A computation of the need for gas transfer aggregates for subsectors and industry as a whole on the basis of a designed method yields reliable results and makes it possible to take into account the changing dynamics which determine technical progress. 2 tables.

ENVIRONMENTAL EFFECTS

REFER ALSO TO CITATION(S) 7351

ARTIFICIAL STIMULATION, PLOWSHARE, ETC.

REFER ALSO TO CITATION(S) 7427, 8643, 9005

7393 (METC/SP—78/6(Vol.1), pp 264-272) **Fracture containment analysis conducted on the Benson pay zone in Columbia Well 20538-T.** Brechtel, C.E.; Abou-Sayed, A.S.; Jones, A.H. (TERRA TEK, Inc.). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

A series of laboratory and field tests have been performed to assess the capability of shale layers above and below the Benson Sandstone to contain a hydraulic fracture that would be created in the Benson pay zone. The laboratory tests revealed that the contrast in elastic moduli between the Benson and surrounding shale layers is unfavorable for such fracture containment. The in situ stress measurements indicated that the minimum in situ stress in the overlying shale layer is 480 psi greater than in the Benson Sandstone. On the other hand, the stress in the shale below the Benson Sandstone was only 180 psi greater. Since these stress contrasts enhance fracture containment, the situation was analyzed to predict the maximum bottom hole treating pressure required to achieve limited fracture extent outside the Benson pay zone. The containment analysis was based upon a limited incursion of the fracture into the upper shales of 5 to 10 feet and 40 to 100 feet into the lower shales. The maximum bottom hole treating pressure for these controlled fracture incursions were calculated for different fracturing fluids, and indicate a low range in permissible treating pressures.

7394 (METC/SP—78/6(Vol.1), pp 291-302) **Stimulation and mineback experiment project: the direct observation of hydraulic and explosive fracturing tests.** Northrop, D.A.; Warpinski, N.R.; Schmidt, R.A.; Smith, C.W. (Sandia Labs., Albuquerque, NM). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Hydraulic and explosive fracturing experiments have been conducted adjacent to an existing tunnel complex at DOE's Nevada Test Site and have been directly observed by subsequent mineback through the experimental area. Activities and accomplishments during the past year include the following (1) Evaluation of a proppant distribution fracture experiment revealed a very complex fracture system. Observed fracture lengths were only 5 and 25 ft at the depth of the fracture interval and these differ significantly from the design lengths of 175 ft. The fracture interacted with numerous geologic faults, fractures, and bedding and parting planes. (2) An experiment was designed and conducted which examined the behavior of hydraulic fractures at an interface between an ash-fall tuff and welded tuff formations. These formations have significant differences in their elastic moduli (0.24×10^6 and 3.8×10^6 psi), Poisson's ratios (0.312 and 0.238) and porosities (45 and 13 percent). Mineback along the interface has revealed a total fracture length of 150 ft at this level. The fracture initiated in the ash-fall tuff broke upwards into the higher modulus formation. (3) In conjunction with a nuclear containment program, the residual stress effects around a contained explosive detonation have been studied. No radial fractures extended from the main cavity. However, explosive gases escaping along a borehole from the cavity produced a fracture estimated to be 75 ft high in the region of reduced in situ stress extending approximately 10 to 40 ft from the cavity. (4) The use of small volume (less than 50 gal) hydraulic fractures in tunnel boreholes has been evaluated for determining in situ stresses and orientations in conjunction with this project.

7395 (METC/SP—78/6(Vol.1), pp 347-359) **Computational analysis of the effect of pulse shape on the fracture of Devonian shale.** McHugh, S.; Keough, D.D.; Seaman, L. (Poulter Lab., Menlo Park, CA). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Explosive stimulation techniques increase permeability by forming multiple fractures, by extending existing fractures, or by employing both processes. Recent studies indicate that dynamic fracture is caused by a flaw activation and growth process controlled by the applied stress interacting with the material fracture parameters. Knowledge of this interaction allows the computation of the effectiveness of various loading techniques. Results of an analysis of pulse shape on fracture distributions are reported. The pulse shapes were chosen to vary the predicted crack size distributions, thereby indicating how the amount and location of damage depend on the pulse shape. The results of the analysis were compared with variations in the fracture distribution produced by changes in the fracture parameters to determine which features of the fracture distributions are sensitive to material property variations and which are sensitive to changes in the input pulse shape. Within the limits of the fracture model, it was determined that the amount and location of tensile cracking in a cylindrical geometry strongly depends on pulse shape. It was also found that optimizing the pulse shape to produce damage in specific locations does not require precise knowledge of the fracture parameters; however, the fracture parameters must be accurately known to quantify the amount of damage.

7396 (SAND—78-1672) **Enhanced gas recovery program. Second quarterly report: fiscal year 1978, January 1—March 30, 1978.** Schuster, C.L.; Northrop, D.A. (eds.). (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 74p. Dep. NTIS, PC A04/MF A01.

Three major field experiments were conducted for fracture mapping during this quarter. These experiments were conducted by Amoco in the Wattenberg field at an intermediate depth in the Sussex formation. Sandia fielded the surface electrical potential system on all three experiments and collected data with the borehole seismic system on a portion of two of the experiments. Sandia also had their Hewlett Packard pressure gage on site and recorded wellhead pressures on two experiments and downhole pressure on the third experiment. Analysis of the data collected on all three experiments will be reported on in subsequent quarterly reports. A second wireline tool utilizing a string of hydrophones is under development. This type of tool will allow fracture heights to be determined from the wellbore but not fracture orientations. The tool can be installed through tubing and, as the hydrophones are pressure sensitive, the tool will not require clamping to the sidewalls for obtaining data. The Stimulation and Mineback experiment project has focused on the evaluation of two experiments conducted at the Nevada Test Site. The complex fracture system observed in the Hole 5 test has been substantiated by conducting small-volume fracturing tests along two boreholes on either side of the Hole 5 region. Two hundred sixty feet of tunnel were subsequently driven along these boreholes and a complex geology with numerous faulting and variable fracture behavior and in situ stress distributions were obtained. Exploratory coring has located the lower fracture created in the Hole 6 test. This location substantiates the azimuth determined from seismic data and has allowed definition of a mining plan along the interface to the borehole.

7397 Acoustic emissions following hydraulic fracturing in a gas well. Power, D.V. (El Paso Natural Gas Co., TX). pp 291-308 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.;

Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

The acoustical monitoring of a hydraulic fracturing of a natural gas well in New Mexico is described. High background noises prevented the detection of any signal during the fracturing operation itself. During the shut-in period of 30 min two types of signals were clearly detected. One exhibited the usual seismic event characteristics of P and S phases and the other type indicated a single phase characteristic. However analytical difficulties have hampered a quantitative definition of these signals. (JSR)

7398 (UCRL—80969) **Theoretical and experimental research on hydraulic fracturing.** Hanson, M.E.; Anderson, G.D.; Shaffer, R.J.; Emerson, D.O.; Heard, H.C.; Haimson, B.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 May 1978. Contract W-7405-ENG-48. 47p. (CONF-780825—12). Dep. NTIS, PC A03/MF A01.

From 4. symposium on enhanced oil and gas recovery and improved drilling methods; Tulsa, OK, USA (29 Aug 1978).

Newly developed two-dimensional numerical models have been applied to analyze the effects of pore pressure on the Mode I stress intensification factor. These analyses indicate that as the fluid migrates from the fracture into the surrounding medium, the stress concentration factor decreases. Other results indicate that for a fracture symmetrically located across an interface between two materials, the stress concentration factor is larger in the material with the higher Young's modulus. Predictions of surface tilt above a vertical hydrofracture and a horizontal layer were made, assuming various elastic parameters in the layer and the surrounding medium and different layer widths and positions relative to the hydrofracture. It was found that the layer geometry and the elastic constants affect both the surface tilt and the local strain field. The growth of cracks near an interface in several materials, including polymethylmethacrylate (PMMA), Nugget sandstone, and Indiana limestone were studied. Results have shown that the mechanical properties of the interface relative to the properties of the materials on either side are important. The fluid pressure at which a crack initiates in limestone also determines whether a crack crosses an unbonded interface under a given load. Other experiments with triaxial loading cells have indicated that when vertical stresses are greater than horizontal stresses, a horizontal stress difference of greater than 75 psi controls the orientation of the fracture. A review was conducted of information generally available about the structure, stratigraphy, geometry, and properties of the Cretaceous and Tertiary media that make up the tight, western gas sands. Analysis of available data from a well in Colorado's Piceance Basin shows that a vertical massive hydraulic fracture with an assumed height of 50 ft had a wing length of approximately 100 ft.

TRANSPORT, PIPELINES, AND HANDLING

REFER ALSO TO CITATION(S) 7293, 7357, 7358, 8400, 8601

7399 **Large rapidly applied loads.** Painter, D.W. (British Gas Corp., London). *Gas Eng. Manage.;* **18**: 278-281(Aug 1978).

A case study involving North West Gas illustrates the problems distribution systems have been facing because of large, rapidly applied loads. The author suggests a large on-off load process as one solution to pressure transients and provides a description and diagrams of the equipment used for the process. Variations of this approach are suggested to meet the specific requirements of other customers.

7400 **Analysis of a failure due to a crack on LNG tanks.** Toyosada, M. *Hitachi Zosen Giho;* **39**: No. 2, 47(Jun 1978).

The sequence of occurrence of a fateful failure on a tank is outlined. The possibility of inspectors missing small initial defects is pointed out, but if the period between detection of LNG leakage and occurrence of brittle fracture is longer than voyage duration (15 days), the LNG carrier is safe. And if a brittle fracture initiates on the tank, the crack usually stops at the fusion line. (DLC)

7401 **Analysis of the interaction force between ship hull and tank for the Hitachi Zosen-CBI spherical tank LNG carrier.** Harada, K.; Tateishi, M.; Ikeda, J. *Hitachi Zosen Giho;* **39**: No. 2, 14-22(Jun 1978).

The Hitachi Zosen-CBI spherical tank LNG carriers features its sliding-type tank-supporting structure consisting of keys and keyways. This support system prevents the occurrence of thermal stresses by allowing the tank's deformations in radial directions, whereas interaction force between the hull and tank would work as concentrated load. In designing such a structure, therefore, the interaction force should be accurately estimated and a design that distributes the interaction force evenly among the keys must be given. Tanks installed on a ship are subjected not only to static loads but also to various wave-induced dynamic loads, and the interaction force resulting from the latter is generally estimated through a statistical analysis procedure. One of the conventional statistical analysis procedures is the square root method. This method, though convenient and less complicated in application, is an approximate procedure based on the assumption that various types of wave-induced load are statistically independent of each other and its deficiency in accuracy is inevitable since such an assumption is seldom valid. In view of the above, the authors developed a new procedure called a "Total System Analysis". In this procedure, the interaction force is statistically analyzed using its response function to a regular wave, so its statistical values are calculated with correlations between the types of wave-induced load taken into account. This paper describes the square root method and total system analysis, compares the interaction force analysis results obtained by these procedures on a 130,000m^3 LNG carrier, and concludes that the square root method considerably overestimates the interaction force.

7402 **Statistical estimation of tank stress by total system analysis for spherical tank LNG carrier. I. Influence of correlations between wave induced loadings on tank stress.** Harada, K.; Tateishi, M.; Ikeda, J.; Kataza, T.; Hori, T. *Hitachi Zosen Giho;* **39**: No. 2, 23-30(Jun 1978).

Stresses in a LNG tank, which are random variables caused by various types of random wave induced loadings, should be treated statistically. The Square Root Method (SRM) is a conventional method for the estimation of maximum expected values of the tank stress resulting from these types of loadings. This method gives an accurate solution in a special case where the loadings are statistically independent and stress response is linear with regard to the loadings. However, there are, in general, certain correlations between wave induced loadings. This paper explains and discusses an analysis procedure called "Total System Analysis Phase I" (TSA) procedure, which has been developed to accurately estimate long-term statistical values of the tank stresses. This procedure is an extension of the concept of the commonly-used statistical analysis of the long-term prediction of response of ship's motions and wave induced loadings. In establishing the procedure specific items such as the introduction of stress response functions and the approximation of probability density functions of tank stress local maxima (or minima) to Rayleigh distributions, etc. are discussed. These items are verified by numerical experiments by a computer. Hitachi Zosen-CBI Spherical Tank LNG Carrier has been analyzed by the TSA procedure; the results show that the correlations between types of wave induced loadings have a large influence on the tank stress.

7403 **Statistical estimation of tank stress by total system analysis for spherical tank LNG carrier. II. Application of evaluated stress to failure analysis.** Hori, T.; Tanaka, M.; Tateishi, M.; Ikeda, J. *Hitachi Zosen Giho;* **39**: No. 2, 31-46(Jun 1978).

In the safety assessment of the Hitachi Zosen-CBI spherical tank LNG carrier, the procedures of stress estimation are divided into two stages. In the first stage, applying the results of ship motion analysis, stress components at each point in the tank are obtained as random processes (Stress Analysis Phase I). Since the stress components can be considered linear to the original load, sea wave, those are regarded as normal random processes. In the second stage, in order to apply the results of the first stage to the next analysis, failure analyses, it is investigated what kinds of stress quantities should be applied to each failure mode, and how to obtain those including their statistical characteristics (Stress Analysis, Phase II). In the present paper, the procedures in the second stage above are mainly discussed, focussing on fatigue strength, crack propagation strength and buckling strength as the main failure modes in the tank of LNG carrier.

7404 **Fatigue crack propagation from an initial defect. Non-through thickness crack (failure analysis step II).** Toyosada, M.; Tateishi, M.; Kitazono, M. *Hitachi Zosen Giho;* **39**: No. 2, 48-53(Jun 1978).

An explanation and backgrounds of the calculation method of fatigue crack propagation from a surface flaw proposed by RR843 Committee are given. This calculation method is surely the most reasonable one for the analysis of surface cracks. This calculation method has been adopted to the HZ-CBI LNG tank. The result proved that the HZ-CBI tank has a long propagation period from an initial defect to the penetration of the tank plate. 7 figures.

7405 **Investigation on fluid flow through a small crack.** Suzuki, M.; Tachibana, T.; Hikino, K.; Okamoto, T.; Sakamoto, T. *Hitachi Zosen Giho;* **39**: No. 2, 64-68(Jun 1978).

For verification of safety of Hitachi Zosen-CBI spherical tank LNG carrier, leak before failure (LBF) concept is applied. The LBF concept consists of the consideration that, if a crack will take place in the LNG tank, this crack can be detected when it is relatively

small before it causes brittle fracture and the tank system can be operated safely for a designated period. With regard to the concept, the fluid flow through a small crack of the tank plate was studied experimentally and theoretically and the following results were obtained from the studies: (1) The theoretical equation and the experimental results agree well. (2) When the penetration crack is small, the flow is laminar and the flow rate is in proportion to the pressure difference and it is in inverse proportion to the coefficient of viscosity. (3) The flow rate is in proportion to the crack width and to the third power of the crack opening displacement. Since the crack opening is in proportion to the stress, the flow rate increases rapidly as the crack extends.

7406 Safety assessment of an LNG tank system by means of LBF concept. Okamoto, T.; Nishimoto, T.; Morozumi, S.; Sakamoto, T. *Hitachi Zosen Giho;* **39**: No. 2, 69-73(Jun 1978).

The concept of leak before failure is a principle to assure the safety of a tank system by proving that, even if a crack takes place in the tank plate, it will not grow to a critical length which may tend to brittle fracture during a designated period. Some means are required to detect the crack in an early stage of its growth and a partial secondary barrier (catch basin) is to be provided to stow unevaporated leaked LNG for a designated period. This concept was applied to the design of the Hitachi Zosen-CBI spherical tank LNG carrier and the following were recognized: (1) Even if a through crack takes place, it can be detected in a very early stage by means of the gas detector. (2) The growth of a crack for 15 days after detection is very small in comparison with the critical crack length, so that the tank can be repaired with an ample margin before the crack leads to brittle fracture. (3) It is found that LNG leakage is little and all of it evaporates. Thus, the catch basin is not required when the all-evaporation fact is taken up.

7407 Construction procedure of tanks of a Hitachi Zosen-CBI spherical tank LNG carrier. Kurata, N.; Ohshima, H.; Nomura, T.; Yamano, M.; Maekawa, C.; Ohmori, M. *Hitachi Zosen Giho;* **39**: No. 2, 74-81(Jun 1978).

This report explains the construction procedure of the spherical tanks of a Hitachi Zosen-CBI spherical tank LNG carrier. These tanks are of 9% Ni steel, and the diameter is about 38 meters. We employed a method of completing the tanks in dock. Two spherically curved shell plates which are formed by newly developed pressing dies are joined together first. Then these parts are assembled and horizontal rings; these rings are assembled one by one to complete a spherical tank. After testing, insulation work is carried out. Each tank is lifted by a floating crane to be installed on a double hull type LNG carrier. Then tank fixing work and remaining insulation work are carried out.

7408 Automatic welding of 9% nickel steel. Minehisa, S.; Nagai, A.; Shirane, Y.; Nakata, T. *Hitachi Zosen Giho;* **39**: No. 2, 82-88(Jun 1978).

A welding wire of Ni-Mo-W alloy has a very good resistivity against hot cracking. This has enabled us to make easier submerged arc welding. In the meantime, owing to the progress in TIG welding machines, automatic welding in all positions has become possible. Besides, other problems to be concerned about the construction of LNG tanks such as magnetic arc blow in TIG welding and a difference in X-ray film density due to difference in the X-ray absorption ratios of base metal and weld metal, have been solved. By applying the results of these studies, automatic welding methods for each joint of the 9% Ni steel spherical LNG tanks have been established.

7409 Application of gas turbines in natural gas transport systems (pipelines). Guenther, J.; Moldenhauser, W. *Tech. Mitt. AEG-Telefunken;* **68**: No. 1/2, 48-53(1978). (In German).

Because of the difficult development situation in the field of natural gas supply in recent years and the resulting requirements, the resulting technical construction expenditure is described for 2 plants. The Ruhrgas AG station at Werne is a typical example of a pipeline station in a closely interconnected natural gas distribution and transport system. Because of the various tasks of the station, high requirements are posed for the method of operation. The effect of environmental conditions on technical design is shown by the example of the Orenburg-Chust pipeline in the USSR. Details are given of the requirements for maintenance-free operation of the stations.

7410 Safe operation of cylinders in the separation of liquified hydrocarbon gases. Khuchua, R.S. *Gazov. Prom-st.;* No. 7, 34-36(Jul 1977). (In Russian).

Results are cited for experimental studies on the elasticity of vapors of binary gas-liquid mixtures formed during contact between gas and a liquid during mixing and pouring operations at gas distribution points. An increase in the vapor elasticity of gas-saturated mixtures was seen to occur with a rise in the separation temperature and pressure. At certain separation pressures and at the initial temperature it was found that the vapor elasticity of the gas-saturated gases at a temperature of 45°C was lower than the permissible operating pressure. This assures the safe operation of the cylinders. 1 table, 2 illustrations, 5 references.

7411 Optimal distribution of computed pressure in rural gasline systems. Levin, A.M.; Rodin, A.K.; Nikitina, N.N. *Gazov. Prom-st.;* No. 7, 36-37(Jul 1977). (In Russian).

A study is made of the optimal pressure distribution in rural gasline systems, and results are cited for determining the optimal computed pressure. Recommendations are given for changing appropriate chapters of construction norms and regulations. 1 table.

7412 Gas pipelines and underground storage. pp 2.60-2.76 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Projected and in-place overland gas lines in the US and Canada are shown using maps. Growth rates in the gas industry are reflected in tables on total US natural gas and synthetic gas requirements versus gas supply during the years 1971 through 1985. Data are also tabulated on required capital expenditures for gas supply during the period 1971 through 1985. Data and information on underground gas storage is included. (JRD)

7413 Marine pipelines. Crossman, A.B. (Brown and Root International Ltd., Houston, TX). pp 2.77-2.89 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Factors unique to marine pipelines are discussed. Information is included on design factors, construction equipment, pre-lay vessels, pontoons and ramps, tensioners, anchoring and positioning, construction procedures, and operations related to construction. Data and discussion are included on the approximate cost of marine pipelines. (JRD)

7414 Gas-mixing control systems. Warner, C.W. (Cutler-Hammer, Inc., Milwaukee). pp 2.96-2.99 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Requirements for gas mixing are discussed along with control systems. In general, a gas-mixing control system consists of a system of volumetric proportioning to establish and maintain an approximate proportion of the constituents in the final mixture for the complete range of sendout requirements, proper calorimetric equipment to indicate and record the mixture calorific value and to permit automatic control of the value to some preselected value, and a Btu-adjusting mechanism which couples the calorimetric proportioning equipment to provide the means for automatically maintaining the mixture calorific value at the desired control point. Examples of gas-mixing control systems are included. (JRD)

PROPERTIES

REFER ALSO TO CITATION(S) 7436, 7437, 7438

7415 (METC/SP—78/6(Vol.1), pp 396-403) **Carbon isotopes in the Devonian shale sequence: utility as provenance indicators.** Maynard, J.B. (Univ. of Cincinnati). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

The type of organic matter present in the shale—marine or terrestrial—may be important in gas generation because terrestrial carbon appears to yield more methane than marine-derived carbon. The ratio of C^{13} to C^{12} in the organic matter of recent sediments (expressed as delta C^{13}) is a function of the provenance of the carbon: non-marine C is relatively negative, around -26, while marine C is about -21. The Devonian Shale sequence also shows a proximal-distal variation in C isotopes. Wood samples and non-marine black shales have delta C^{13} values of -25 to -26, similar to the modern value. Marine shales, however, are more negative, ranging from -27 to -31, the values becoming more negative to the west and northwest within a given stratigraphic interval. Carbon isotopes also reflect distal-proximal changes in the organic matter at a given locality. Usually, gray shales have less negative (i.e. less marine) values than black shales. For instance, the Bedford gray shale in Richland County, Ohio averages -27.6 whereas the immediately underlying Cleveland black shale averages -29.2. There is no explanation for the difference between the Devonian and the recent pattern, except to suggest that perhaps the marine organisms were different. Carbon isotope results suggest that Eastern Kentucky and Western West Virginia should be the most favorable areas for gas, and that Central Ohio and the Illinois Basin should be poor.

7416 (METC/SP—78/6(Vol.1), pp 431-442) **Diffusion experiments on cored samples of Devonian shale.** Smith, R.D. Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

A study was conducted to measure the diffusion coefficients of methane in certain shale samples from gas wells in Ohio and West Virginia. Seven experimental tests were carried out on six different samples taken from 4-inch core. The method used was gas flow through a slab of shale by applying high pressure on one side. The pressure increase was measured on the low pressure side with a mercury manometer. Pure methane gas was used as the permeating fluid. The mathematical treatment was based on Paul and DiBenedetto. The solution involved the summation of an infinite series which was solved by computer. It was determined that 200 terms of the series were sufficient to give the desired accuracy. An average diffusion coefficient was found to be about 6.8×10^{-8} cm²/s (1.9×10^{-10} darcys). The range went from unmeasurable to 4.7×10^{-7} cm²/s (1.3×10^{-9} darcys). The unmeasurable test ran for 24 days and the concentration of gas did not increase in the low pressure chamber. This mathematical method is excellent for determining very small diffusivities because of its time dependence. That is the longer a test is continued, the smaller the diffusivities that can be measured.

7417 Liquefaction of a vapor utilizing refrigerants of LNG. Muska, A.V. (to Airco, Inc.). US Patent 3,962,881. 15 Jun 1976. vp.

Airco, Inc.'s new process liquefies a vapor such as carbon dioxide gas by utilizing the refrigeration available in LNG to subcool liquid carbon dioxide, which in turn is sprayed into carbon dioxide gas in a condensing vessel to liquefy the gas. Suitable control means are used to maintain a predetermined temperature within the condensing vessel and regulate the flow rate of LNG in response to variations in the flow of liquid carbon dioxide prior to the subcooling of the liquid CO_2 by the LNG.

COMBUSTION

REFER ALSO TO CITATION(S) 7575, 7577, 7578

7418 Calorimetric measurement of gaseous fuels. Warner, C.W. (Cutler-Hammer, Inc., Milwaukee). pp 2.90-2.95 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Methods of defining the energy content of gaseous fuels are discussed. Information is included on the characteristics of water flow calorimeters, recording calorimeters, thermometers, sigma calorimeters, reineke calorimeters, union calorimeters, and gas chromatographs. The effects of gas composition and gas sampling are discussed. (JRD)

7419 Gas burner. Godijn, W. (to Research Instituut Sesto B.V.). US Patent 3,958,762. 25 May 1976. vp.

The new ribbon burner developed by Research Instituut Sesto B.V., the Netherlands, for boiler use permits very low premixing rates of 10 to 20%--without incomplete combustion--for higher port loads and more compact burner and boiler design. To accomplish this, the design improves the supply of secondary air in the burner by shifting the spacing facing the gas-supply side by half a pitch relative to the spacing facing the flame side.

STORAGE

7420 Liquefied natural gas (LNG). pp 2.100-2.115 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Safe handling of LNG is discussed. An analysis of an accident in Cleveland, Ohio, on October 20, 1944 involving LNG tank failure is presented. Information and discussion are included on LNG spills, liquefaction processes, and construction materials for LNG handling equipment. (JRD)

7421 Cryogenic construction and article therefor. Smith, H.S. Jr. (to Dow Chemical Co.). US Patent 3,954,539. 4 May 1976. vp.

Dow Chemical Co. has developed a cryogenic insulation that has a reduced cracking tendency, is readily fabricated from available materials, and is especially useful when applied by the spiral generation method. The insulation consists of synthetic resinous closed-cell thermoplastic foams. One end of an elongate insulating member is laminated in a J-shaped configuration with one edge folded outward about 180° to form a flange. The laminate, which consists of a layer of metal and a layer of heat-sealable adhesive, has transverse corrugations to control buckling. Perpendicular to the inner face of the elongate are other elongate insulating members arranged with scrims or fiber reinforcements to reduce crack initiation.

OIL SHALES AND TAR SANDS

7422 Fuel from tar sands. Dickie, B. (Minister of Mines and Minerals, Alberta, Canada); Carrigy, M. pp 3.159-3.167 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The occurrence of tar sands throughout the world and especially in North and South America is discussed. Information is included on the nature of the deposits, exploitation, methods of upgrading the bitumen, and synthetic oil production from the Alberta oil sands. (JRD)

RESERVES AND EXPLORATION

REFER ALSO TO CITATION(S) 7328

7423 (TID—28867) **Black shale studies in Kentucky. Quarterly report, June 1978.** (Kentucky Univ., Lexington (USA)). 1978. Contract EY-76-C-05-5202. 70p. Dep. NTIS, PC A04/MF A01.

Results of the studies are presented in sections on geochemical characterization including mineralogic analyses, elemental analyses, and radioelement determinations. Work devoted to stratigraphic studies is reported in sections on surficial stratigraphy and core archiving. (JRD)

SITE GEOLOGY AND HYDROLOGY

SITE GEOLOGY

REFER ALSO TO CITATION(S) 7371, 7374, 7376, 7378, 7380, 7381, 7416

7424 (METC/SP—78/6(Vol.1), pp 280-290) **Appraisal of known Antrim shale and Berea oil and gas pools in Michigan.** Ells, G.D. (Michigan Dept. of Natural Resources, Lansing). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

The bituminous and combustible nature of lower Antrim black shales in the Michigan Basin has been known for over 100 years. Antrim Shale gas has been produced for many years, and analyses of its potential oil content were published more than 60 years ago. Now a program is underway to test the feasibility of in situ processing of Michigan's Antrim Shale to produce energy values. Important tasks associated with the total program have involved the construction of geologic cross sections and an appraisal of known oil and gas pools whose reservoirs are within rocks of the black shale sequence. The black shale sequence involves rocks of Upper Devonian and Lower Mississippian age, and includes the Antrim Shale, Ellsworth Shale, Bedford Shale, Berea Sandstone and Sunbury Shale. Stratigraphic cross sections constructed from gamma ray logs show the complicated relationship of these formations in an east to west direction across the Basin. Antrim gas pools are found in several areas of the Basin. Oil and gas pools are also found in the Berea Sandstone of eastern Michigan and in the Ellsworth Shale, a western facies involving the upper part of the Antrim, Bedford, Berea and Sunbury formations of eastern Michigan. A map shows the location of pools discovered to date. Oil and gas pools, cumulative production and other pertinent data are tabulated.

DRILLING, FRACTURING, AND MINING

REFER ALSO TO CITATION(S) 7377, 7395

7425 (LA—7338-PR) **Explosively produced fracture of oil shale. Progress report, January—March 1978.** Carter, W.J. (comp.). (Los Alamos Scientific Lab., NM (USA)). Sep 1978. Contract W-7405-ENG-36. 18p. Dep. NTIS, PC A02/MF A01.

Much of the oil shale program effort at the Los Alamos Scientific Laboratory during the past quarter involved preparations for the intermediate-scale field tests that are due to begin in July 1978 at the Colony Mine. Laboratory work in material studies, explosive characterization, and computer predictive modeling development have therefore proceeded at a slower rate. Considerable effort has been devoted to performing and interpreting flash x-radiographic studies of cavity formation in a spherical geometry. The experimental results are not yet understood, but anisotropic effects seem to play a strong role both in wave propagation and plastic deformation. These studies will continue. Also, computer simulation studies of rubbing caused by different explosives in the

same material and geometry have been performed. Although the fracture criterion for rubbing is not sophisticated enough to allow quantitative comparison of rubbing efficiency, the general features of the calculations do allow at least a qualitative comparison and therefore are useful for determining emplacement geometry, timing, and boostering.

7426 (SAND—78-1282) **Continuum fracture and fragmentation of rock: application to oil shale.** Grady, D.E.; Kipp, M.E. (Sandia Labs., Albuquerque, NM (USA)). Jul 1978. Contract EY-76-C-04-0789. 41p. Dep. NTIS, PC A03/MF A01.

Progress on development of dynamic fracture, fragmentation, and stress wave propagation models specific to energy applications in rock is reported. Emphasis is focused on physical characterization of the fracture process and on improving computational efficiency. A description of the distribution of flaws characterizing fracturability of rock is quantified which leads to a rate-dependent fracture strength of rock. The resulting constitutive laws of fracture are examined in terms of processes of dynamic fracture in oil shale.

OIL PRODUCTION, RECOVERY, AND REFINING

REFER ALSO TO CITATION(S) 8422

IN SITU METHODS, TRUE AND MODIFIED

REFER ALSO TO CITATION(S) 7426

7427 (METC/SP—78/6(Vol.1), pp 230-239) **In sintu processing of Michigan Antrim: field tests.** Matthews, R.D.; Humphrey, J.P.; McNamara, P.H.; Kinkel, C.G.; Peil, C.A. (Dow Chemical Co., Midland, MI). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

The Dow Chemical Company is the prime contractor with DOE in a four-year, $14 million project to assess the feasibility of recovering energy from Antrim oil shale by in situ process. The contract requires that three different fracturing techniques be tried and evaluated in field experiments at the experimental site in Sanilac County, Michigan. The hydrofracturing experiments should be complete by the fall of 1978; chemical underreaming and explosive underreaming experiments are underway. The technique judged most promising of these three in preparing an area for in situ extraction is to be the subject of an ignition attempt. In the first two years, three in situ combustion trials have been made in a group of wells which were drilled by Dow to the DOE contract. During the most recent of these trials, in situ combustion was maintained for a 61-day period while several continuous and cyclic production procedures were tested. Gas having energy values in the target range (150 btu/scf) was produced at various times, although the flow rate at these times was minimal and hence the energy production was low.

7428 Analysis of transient temperature distribution in oil shale due to heat source propagating in retort. Wilhelm, H.E.; DuBow, J.B.; Hong, S.H. (Department of Electrical Engineering, Colorado State University, Fort Collins, Colorado 80523). *J. Appl. Phys.;* **49**: No. 12, 5768-5773(Dec 1978).

The initial-boundary-value problem for the transient temperature fields in oil shale, which is heated by a propagating combustion flame in an in situ retort chimney, is formulated and solved analytically. The heat source of the flame is represented by a Gaussian distribution, which models the average statistical variations in radial and axial flame extensions, and is assumed to build up to maximum strength in accordance with a temporal relaxation process. The transient temperature fields in the oil shale surrounding the retort are calculated and discussed with respect to their spatial variations and dependence on the flame relaxation time. The theoretical temperature distributions are shown to be consistent with those observed experimentally. The high-temperature core extends less than a retort radius into the surrounding shale bed. This result has implications for (i) the in situ retort design and (ii) the environmental impact of in situ retorts. It appears that the spacing between neighboring retorts can be reduced and that the thermal effects of retorts on the environment are less severe than previously anticipated.

7429 In-situ methods of extracting bitumen values from oil-sand deposits. Rabbitts, L.C. US Patent 4,101,172. 18 Jul 1978. Priority date 22 Dec 1975, Canada. 28p.

The present invention provides a method of in situ extraction of bitumen from an oil-sands body which method comprises sinking an access shaft through the oil-sands body, driving an access drift in the rock strata underlying the oil-sands body, delineating a rectangular block of oil-sands in said body by drilling and blasting the oil-sands body to provide substantially vertical planes of fractured oil-sands on all four sides of an enclosed mining room capable of retaining liquids and gases under pressure and comprising solid pillar walls, providing generally upwardly extending bores in said block of oil sands from the access drift in the said body, providing perforated pipes in those portions of the bores in said block, the perforations of said pipes being dimensioned to prevent sand particles from said block passing therethrough, increasing the permeability of the block of oil sands within said room by fracturing said block, flooding the mining room with a hot fluid at a temperature and for a residence time sufficient to raise the temperature of the block by an amount to cause the bitumen to become flowable with said fluid and removing the fluid-bitumen mixture so formed from said block, the passage of said fluid through said bed being via said perforated pipes and separating said bitumen from said fluid.

7430 Oil recovery process utilizing air and superheated steam. Allen, J.C. (to Texaco Inc.). US Patent 4,098,336. 4 Jul 1978. Filed date 10 Mar 1976. 8p.

Petroleum may be recovered from viscous petroleum containing formations including tar sand deposits by first creating a fluid communication path in the formation, followed by injecting via an injection well a fluid comprising superheated steam and air into the formation via the fluid communication path whereby in situ combustion occurs providing heat and pressure for driving the petroleum in the formation toward the production well. Recovery of the displaced petroleum is accomplished via the production well.

SURFACE METHODS

7431 (UCID—17849) **Computer code to generate contour plots of retort temperature data.** Ackerman, F.J.; Sherman, N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1978. Contract W-7405-ENG-48. 55p. Dep. NTIS, PC A04/MF A01.

Oil shale retorting experiments are being performed in two retorts; a small 125 kg (1' x 5' retort and a large 6 tonne (3' x 20') retort. Temperature data from the retorting experiments is studied in several ways. Detailed measurements of temperature propagation through both retort beds are made by an array of 13 thermocouples on each of two horizontal planes across the bed. The MOVIES code permits visual examination of this data in a time sequence. The code produces a series of three-dimensional contour plots of the temperature data with one or more frames for each time the array data is recorded. Options in the code allow rotation of the image at any time step in order to gain a clearer view of the temperature surface. Some of the features of the code are described and directions for its use are provided.

7432 Recovery of hydrocarbonaceous material from tar sands. Rammler, R.; Schmalfeld, P.; Weiss, H.J. (to Metallgesellschaft AG). US Patent 4,098,674. 4 Jul 1978. Priority date 2 Apr 1976, Canada. 6p.

The present invention relates to a process for the recovery of hydrocarbonaceous materials from tar sand comprising subjecting a part of the tar sand to hot water extraction by mixing it with hot water, the solids and bitumen being separated and the latter treated further, and carrying out a dry distillation of another part of the tar sand which is thereby heated to temperatures above 400°C, the gaseous and vaporous distillation products being cooled and condensed. This process is characterized in that at least a portion of the thermal energy required for hot water extraction originates in the dry distillation waste heat. This process is further characterized in that the solid coke-like residue recovered from the further treatment of the bitumen from hot water extraction is used as fuel in the dry distillation and in that the wet solids recovered from hot water extraction are mixed with the dry distillation residue to form a solid product which can be transported on belt conveyors.

7433 Tests for radiation fluidsation of Athabasca tar sands. Nagra, S.S.; Armstrong, D.A.; Adam, F.C. *Energy Process./Can.;* **71**: No. 1, 58, 60-62, 64(1978).

The effect of ionizing radiation on the viscosity of oil sands bitumen and on the molecular weights of asphaltene fractions have been investigated. The changes in these properties relative to unirradiated controls are small, and it is concluded that ionizing radiation per se does not provide an attractive method for fluidization of Athabasca Oil Sands bitumen.

7434 Oil shale retorting. Atwood, M.T. (Oil Shale Corp., Golden, CO). pp 3.147-3.158 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Oil shale retorting technology and practice in the US are reviewed. Information is included on N-T-U retorting, gas combustion processes, and horizontal retorting. (JRD)

REFINING

7435 Separation of nitrogenous materials from bitumen and heavy oils. Sawatzky, H.; Ahmed, S.M.; George, A.E.; Smiley, G.T.

(Dept. of Energy, Ottawa). *Energy Process./Can.;* **71**: No. 1, 65-70(1978).

Separation of nitrogenous compounds and associated polar materials from deasphalted Athabasca bitumen has been studied by modified API-USBM procedures. It was found that only limited elution or extraction of the ion exchange resins was required compared with the exhaustive extractions of the unmodified method. 11 tables, 7 figures.

PROPERTIES AND COMPOSITION

REFER ALSO TO CITATION(S) 7415, 7416, 8414

7436 (METC/SP—78/6(Vol.1), pp 273-279) **Analysis of black shale by inductively coupled plasma.** Lechler, P.; Leininger, R.K. (Indiana Geological Survey, Bloomington). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

A major portion of the inorganic analysis of New Albany Shale by the Indiana Geological Survey will be performed on a direct-reading inductively coupled (argon) plasma-optical emission spectrometer. The major rock-forming elements (except oxygen, carbon, sulfur, and hydrogen) will be determined by ICP after dissolution of the 850°C ash in a Teflon (TM) bomb of unique design. Several trace elements will also be determined by ICP after wet ashing and dissolution by hydrofluoric acid. Initial results from the spectrometer have shown that it is accurate for the determination of both major metallic and several trace elements in silicate rocks. The results for two reference samples by ICP versus other analytical methods are compared. Major and some trace element data for the Phegley No. 1 core, Sullivan County, Indiana, are also presented.

7437 (METC/SP—78/6(Vol.1), pp 330-338) **Investigation of organic matter isolated from Eastern gas-bearing shale.** Tang, J.I.S.; Young, D.K.; Chow, E.; Yen, T.F. (Univ. of Southern California, Los Angeles). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Both bitumen and kerogen concentrates isolated from cored Devonian shales originating near Cottageville, West Virginia were subjected to structural studies. The distribution of carbon in Devonian shale bitumen ranges from C_{13} to C_{18}. GC-MC of the neutral oil fractions of the Devonian shale bitumen showed extensive aromatic systems. Typical studies of acid fractions subjected to GC-MS indicated that the major portion of Devonian shale kerogen structure is composed of straight-chain mono- and di-carboxylic acids with large amounts in two series ranging from C_9 to C_{18} and C_6 to C_{16}, respectively. Some benzene-substituted carboxylic acids were also detected in the oxidized Devonian shale kerogen. Branched alkanes are more abundant in Devonian shale kerogen. Cycloparaffins, though plentiful in Green River shale kerogen, were absent in Devonian shale. This preliminary investigation suggests that the potential for producing gas from Eastern gas-bearing shale (such as Devonian) is probably due to the fragmentation from its bulk organic matter into smaller structural units. Maturation from a youthful shale to Devonian shale may involve simultaneous disproportionation to produce simple molecules, such as methane on one hand, and complex molecules, such as the highly aromatic species trapped in kerogen, on the other hand.

7438 (METC/SP—78/6(Vol.1), pp 339-346) **Summary of chemical analyses and some geochemical controls related to Devonian black shales from Tennessee, West Virginia, Kentucky, Ohio, and New York.** Leventhal, J.S. (Geological Survey, Denver). Oct 1978.

From 2. Eastern gas shales symposium; Morgantown, WV, USA (16 Oct 1978).

In Second Eastern Gas Shales symposium: preprints.

Major and minor trace elements in drill cores from localities in the Appalachian Basin were determined. Results of these analyses are summarized and discussed. It is noted that the trace elements showing variations are generally those that are soluble under oxidizing conditions. The shales of the Appalachian Basin in late Devonian time were formed from sediments with varying amounts of organic matter. This amorphous and structured organic matter contained functional groups which could ion-exchange or chelate trace metals. If enough organic matter was present, the sediment-water interface became anoxic. The absence of oxygen and presence of dissolved sulfate and of organic matter provided conditions for sulfate reducing micro organisms to operate. The sulfides produced could scavenge iron and other trace elements from the overlying water. Thus trace elements bound to the organic material and scavenged by sulfides were incorporated into the sediment which was to become the black shale.

7439 **Geochemical study of the Uinta Basin: formation of petroleum from the Green River formation.** Tissot, B. (Inst. Francais du Petrole, Rueil, France); Deroo, G.; Hood, A. *Geochim. Cosmochim. Acta;* **42**: No. 10, 1469-1485(Oct 1978).

Kerogen from the Green River formation is rich in lipid material and contains predominantly aliphatic chains, with subordinate saturated cyclic material. Compositional differences due to the environment of deposition are observed in the extractable hydrocarbons. The influence of microbial degradation during deposition of organic matter is intense in the stratigraphically lowest zone and decreases toward younger beds, where fossil molecules derived from higher plants, algae and other planktonic organisms and bacteria are abundant. The great depth of the oil generation stage may be explained by a combination of (a) a relatively low geothermal gradient, and (b) a high oil generation threshold. The lower part of the formation has reached the principal stage of oil generation and is responsible for most of the crude oils produced in the Uinta Basin. 12 figures.

7440 **Graduated ozonization of oil shale kerogen.** Egor'kov, A.N.; Mostetskii, I.; Yakovlev, V.I.; Proskuryakov, V.A. (Leningrad Order of Labor Red Banner Technological Inst.). *Khim. Tverd. Topl.;* No. 2, 53-56(1977). (In Russian).

The possibility of the complete degradation of Baltic shale kerogen into products soluble in acetic acid, and into carbon oxides in the presence of ozonized oxygen is demonstrated. Characteristics of change in element composition and other properties of kerogen and soluble degradation products are tracked in a stage-wide process. 1 diagram, 4 tables, 9 references.

7441 **Study of graduated kerogen ozonization products.** Egor'kov A.N.; Mostetskii, I.; Yakovlev, V.I.; Proskuryakov, V.A. (Leningrad Order of Labor Red Banner Technological Inst.). *Khim. Tverd. Topl.;* No. 2, 57-64(1977). (In Russian).

Graduated kerogen ozonization products of Gdov shale were studied following their separation by solubility by infrared spectroscopy, and gel and gas-liquid chromatography. A combination of gas chromatography and mass spectrometry were used to identify the components. Identified among the ozonization products were n-monocarboxylic acids C_6--C_{20}, n-dicarboyxlic acids C_2--C_{16}, and levulinic acids and other compounds. Graduated kerogen ozonization can be used for producing the lower dicarboxylic acids. 5 diagrams, 2 tables, 8 references.

7442 **Comparative characteristics of organic matter in Devonian and Jurassic shale oil in the Ukhtinskii fields.** Urov, K.E.; Listrem, A.I. (Inst. of Chemistry, Tallin, USSR). *Khim. Tverd. Topl.;* No. 2, 71-77(1977). (In Russian).

The composition of bitumens and semicoking resins of oil shale from the Ukhtinskii fields was studied by chromatographic methods. Problems in the genesis of the indicated oil are discussed. 4 diagrams, 5 tables, 25 references.

DIRECT USES AND BY-PRODUCTS

REFER ALSO TO CITATION(S) 8423

7443 **Potential for utilizing Syncrude's byproduct fluid coke.** Ambrose, P.T.; Flynn, P.C. *Energy Process./Can.;* **71**: No. 1, 46-50(1978).

Syncrude's Mildred Lake tar sand complex will produce 2,000 tonnes per day of byproduct fluid coke. Present plans are to stockpile this material until technology is available for its economic and efficient utilization. This study examines several alternatives for coke utilization, employing technology available now or in the near future. The properties of fluid coke and the basis for selection of cases is discussed. Cases evaluated include air oxygen gasification to make a low or medium-Btu gas for in-plant use, and generation of electrical power via direct combustion (with flue gas desulfurization) and combustion of gasified fluid coke. Technical, environmental, and economic aspects of these cases are discussed. The conclusion of this study is that continued stockpiling until the development of a more favorable combination of available technology and economic incentive is the most economic alternative presently available.

7444 **Study of shale pitch as an anode mass cement for industry.** Chalik, S.M.; Sverdlin, V.A.; Shmagin, Ya.G.; Lasukova, L.P.; Denisenko, V.I. *Khim. Tverd. Topl.;* No. 2, 84-94(1977). (In Russian).

Studies were made of the properties of shale pitch produced by thermal cracking at atmopheric pressure of generator, hydraulic, and chamber tars with a softening point of 76 to 82°. The pitch approximates average temperature pit coal pitch with respect to its properties and behavior in an anode mass. 8 tables, 3 diagrams, 7 references.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 8422

WASTE RESEARCH AND MANAGEMENT

REFER ALSO TO CITATION(S) 7445

ENVIROMENTAL ASPECTS

REFER ALSO TO CITATION(S) 7269

7445 (DOE/EV—0015, pp 51-55) **Oil shale.** Jun 1978.

In Division of Environmental Control Technology program, 1977.

Three DOE-sponsored oil shale projects are briefly summarized: assessment of environmental control for waste waters in in-situ oil shale retorting; environmental control implications of oil shale development on water quality; and analysis of the environmental control for oil shale development. (LK)

NUCLEAR FUELS

REFER ALSO TO CITATION(S) 7504

RESERVES

REFER ALSO TO CITATION(S) 7489

7446 (CONF-771155—P1, pp 5-17) **United States uranium position.** Boyd, J.; Silver, L.T. Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

For the immediate future the magnitude of uranium reserves are far more important than the ultimate size of the resources which may eventually be found. The rate at which new uranium reserves can be found and equipped to feed the lightwater reactors is a vital factor in the transition to more advanced conversion systems such as the Liquid Metal Breeder. The breeders require substantial accumulations of recycled plutonium and uranium in their inventories before they can sustain their growth from the recycling of their own wastes.

7447 (NUREG/CP—0004(Vol.2), pp 499-505) **Dosimetry of prehistorical reactors.** Naudet, R. (CEA, Saclay, France). 1977. (In French).

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Two billion years ago, natural fission reactors were "operating" in the Oklo uranium ore deposit. The site has remained in a state of remarkable preservation, such as the reaction rates, distributions are still measurable in the ground. Appropriate dosimetry has been developed for these very peculiar reactors. The data obtained from various isotopic analysis of fission products are very consistent. Nevertheless, detailed investigations show that, even for the most stable elements, small geochemical remobilizations have occurred. The paper reviews the different methods carried out and their reliability.

EXPLORATION

7448 (GJBX—38(78)) **Procedures and regulations for airport calibration pads, Walker Field, Grand Junction, Colorado.** Ward, D.L.; Stromswold, D.C. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Aug 1978. Contract EY-76-C-13-1664. 30p. Dep. NTIS, PC A03/MF A01.

DOE provides airport calibration pads in Grand Junction, Colorado, as a service to those desiring to calibrate surface or airborne gamma-ray spectrometers. The information in this document provides procedures to help facility users obtain maximum benefit from the pads and to advise them of those regulations with which they must agree to comply when permission for usage is granted. Excerpts from the airport rules and regulations are included.

7449 (GJBX—41(78)Vol.3)) **Geology.** (Geological Survey, Washington, DC (USA)). Apr 1977. Contract EY-76-C-13-1664. 59p. U.S. Geological Survey, Washington DC.

Volume 3 consists of maps that accompany report GJBX-41(78) "Uranium Favorability of the Cook Inlet Basin, Alaska". (LK)

7450 (GJBX—99(78)) **Monitoring of the airport calibration pads at Walker Field, Grand Junction, Colorado for long-term radiation variations.** Stromswold, D.C. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Aug 1978. Contract EY-76-C-13-1664. 39p. Dep. NTIS, PC A03/MF A01.

Monitoring of radiation from the US Department of Energy Calibration Pads located at Walker Field Airport, Grand Junction, Colorado has been initiated to detect possible long-term variations in the radioactive character of the pads. A NaI detector is being used to collect spectral data over the energy range 0.5 to 3 MeV. For the first 7 months of the monitoring, an increase of approximately 10 percent in the apparent uranium concentration of the pads was detected during the winter of 1978. This increase is attributed to radon buildup in the pads due to meteorological effects. Information is also presented on the physical description of the pads, their radiometric concentrations and uniformity, and the effects of rainwater on observed radiation.

7451 (GJBX—100(78)(Vol.2-B)) **Aerial radiometric and magnetic reconnaissance survey of portions of the Great Plains and Central Lowlands, O'Neill Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 124p. Dep. NTIS, PC A06/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer survey of the O'Neill Quadrangle, Nebraska, are presented. The work was done by Texas Instruments Incorporated under Bendix Field Engineering Corporation Subcontract No. 77-072-L, as part of the U.S. Department of Energy National Uranium Resource Evaluation (NURE) Program. Descriptions of instrumentation and methods are given in Volume 1 of this final report. Statistical and geologic analysis of the radiometric data revealed 15 uranium anomalies worthy of field checking as possible prospects. The cluster of anomalies in the northeast part of the quadrangle appears to be associated with outcrops of the Pierre Shale and Ogallala Formation that are believed to have the best potential for possible economic uranium deposits. The Pierre Shale may have long-range potential as a low-grade uranium source if the Sharon Springs Member is present in this quadrangle.

7452 (GJBX—100(78)(Vol.2-F)) **Aerial radiometric and magnetic reconnaissance survey of a portion of the Great Plains and Central Lowlands, Great Bend Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 146p. Dep. NTIS, PC A07/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Great Bend Quadrangle, Kansas, are presented. Instrumentation and methods are described in Volume 1 of this final report. The work was done by Texas Instruments Incorporated under Bendix Field Engineering Corporation Subcontract No. 77-072-L as part of the U.S. Department of Energy National Uranium Resource Evaluation (NURE) Program. Statistical and geologic analysis of the radiometric data revealed 12 uranium anomalies worthy of field checking as possible prospects. Another 12 statistically significant uranium anomalies, suspected of being caused by surface contamination by Ra-rich oilfield brines, should be checked for confirmation of that cause. The distribution of uranium anomalies roughly follows the outcrop pattern of the Dakota and Ogallala Formations that are thought to have the best potential for possible economic uranium deposits.

7453 (GJBX—100(78)(Vol.2-G)) **Aerial radiometric and magnetic reconnaissance survey of portions of the Great Plains and Central Lowlands Pratt Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 186p. Dep. NTIS, PC A09/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer survey of the Pratt Quadrangle, Kansas, are presented. The work was done by Texas Instruments Incorporated under Bendix Field Engineering Corporation Subcontract No. 77-072-L, as part of the Department of Energy National Uranium Resource Evaluation (NURE) Program. Descriptions of instrumentation and methods are given in Volume 1 of this final report. Statistical and geologic analysis of the radiometric data revealed nine uranium anomalies worthy of field checking as possible prospects. The anomalies in the northwest part of the quadrangle appear to be associated with the Ogallala Formation, which is believed to have the best potential for possible economic uranium deposits.

7454 (GJBX—100(78)(Vol.2-H)) **Aerial radiometric and magnetic reconnaissance survey of portions of the Great Plains and Central Lowlands, Dodge City Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 146p. Dep. NTIS, PC A07/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Dodge City Quadrangle, Kansas, are presented. Instrumentation and methods are described in Volume 1 of this final report. The work was done under Bendix Field Engineering Corporation Subcontract No. 77-072-L, as part of the U.S. Department of Energy National Uranium Resource Evaluation (NURE) Program. Statistical and geological analysis of the radiometric data revealed 27 uranium anomalies worthy of field checking. Nearly all of these are known or suspected to be associated with the Ogallala Formation. The Ogallala and Dakota Formations are thought to offer the best possibilities for economic uranium deposits in this region.

7455 (GJBX—100(78)(Vol.2-K)) **Aerial radiometric and magnetic reconnaissance survey of portions of the Great Plains and Central Lowlands, Wichita Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 184p. Dep. NTIS, PC A09/MF A01.

The results of a high sensitivity aerial gamma-ray spectrometer survey of the Wichita Quadrangle, Kansas, are presented. The work was done by Texas Instruments Incorporated under Bendix Field Engineering Corporation Subcontract No. 77-072-L as part of the Department of Energy National Uranium Resource Evaluation (NURE) Program. Descriptions of instrumentation and methods are given in Volume 1 of this final report. Statistical and geologic analysis of the radiometric data revealed five uranium anomalies worthy of field checking as possible prospects. These are believed to be related either to uraniferous black shales or to radium-rich oilfield brines. The anomalies in Pc (Chase Group) and Ps (Shawnee Group) should be checked to verify that they are related to radium-rich oilfield brines.

7456 (GJBX—100(78)(Vol.2-M)) **Aerial radiometric and magnetic reconnaissance survey of portions of the Great Plains and Central Lowlands, Enid Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 262p. Dep. NTIS, PC A12/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer survey of the Enid Quadrangle, Oklahoma, are presented. The work was done by Texas Instruments Incorporated under Bendix Field Engineering Corporation Subcontract No. 77-072-L as part of the Department of Energy National Uranium Resource Evaluation (NURE) Program. Descriptions of instrumentation and methods are given in Volume 1 of this final report. Statistical and geologic analysis of the radiometric data revealed 9 uranium anomalies worthy of field checking as possible prospects. The Wellington Formation probably holds the greatest potential for economic uranium production.

7457 (GJBX—113(78)(Vol.2-1)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Talkeetna Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 294p. Dep. NTIS, PC A13/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Talkeetna Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed six uranium anomalies worthy of field checking as possible prospects. Three are located over (or were derived from) granites that are believed to have the best potential for future economic vein-type uranium deposits. Two anomalies, located in (or derived from) Cretaceous-Jurassic sedimentary rocks, may be associated with shales or tuffs, and one anomaly located in Quaternary alluvium may be derived from a uranium prospect somewhere upstream from its site.

7458 (GJBX—113(78)(Vol.2-A)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Circle Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 166p. Dep. NTIS, PC A08/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Circle Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed two uranium anomalies worthy of field checking as possible prospects. One is located over Mesozoic granite which is believed to have the best potential for future economic uranium deposits in either vein deposits or porphyry-type uraniferous late-stage differentiates. Another particularly strong uranium anomaly is associated with Circle Hot Springs, and is thought to be attributable to radium-rich hot-spring deposits which may be taken to indicate potential for uranium mineralization in that region.

7459 (GJBX—113(78)(Vol.2-B)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Charley River Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 278p. Dep. NTIS, PC A13/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Charley River Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed four uranium anomalies worthy of field checking as possible prospects. One is located over Mesozoic granite, which is believed to have the best potential for future economic uranium deposits. Two anomalies are related to sediments of the Porcupine Plateau and one other to Precambrian red beds of the Tindir Group in the Kandik Basin.

7460 (GJBX—113(78)(Vol.2-C)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Fairbanks Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 244p. Dep. NTIS, PC A11/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Fairbanks Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed two uranium anomalies worthy of field checking as possible prospects. One is located over Quaternary swamp deposits and may reflect the accumulation of uranium in peaty material. The second anomaly is associated with the Mississippian Totatlanika Schist and may reflect a deposit similar to the Liberty Bell Mine in the south-central part of the quadrangle.

7461 (GJBX—113(78)(Vol.2-D)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Big Delta Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 136p. Dep. NTIS, PC A07/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Big Delta Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed two uranium anomalies worthy of field checking as possible prospects. One is located over Tertiary-Mesozoic granite which is believed to have the best potential for future economic uranium deposits. The other uranium anomaly is associated with Paleozoic-Precambrian schist and may be related to an unmapped granitic intrusion within it.

7462 (GJBX—113(78)(Vol.2-E)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Eagle Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 211p. Dep. NTIS, PC A10/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Eagle Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed five uranium anomalies worthy of field checking as possible prospects. Three are located over (or were derived from) Tertiary-Mesozoic granite, which is believed to have the best potential for economic uranium deposits. Another anomaly is located in the Devonian Nation River Formation, which has the characteristics of a possible host rock for sedimentary uranium deposits.

7463 (GJBX—113(78)(Vol.2-F)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Mt. McKinley Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 278p. Dep. NTIS, PC A13/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Mt. McKinley Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed six uranium anomalies worthy of field checking as possible prospects. Two are located over granites which are believed to have the best potential for future economic vein-type uranium deposits. Three anomalies may be caused by sedimentary uranium in the Tanana-Kuskokwim Lowland, and one anomaly, located in Paleozic sedimentary rocks, may be associated with slates.

7464 (GJBX—113(78)(Vol.2-G)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Healy Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 248p. Dep. NTIS, PC A11/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Healy Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological anlysis of the radiometric data revealed nine uranium anomalies worthy of field checking as possible prospects. Six are located over (or are suspected of being associated with) Tertiary-Mesozoic granites which are believed to have the best potential for future economic uranium deposits. Another uranium anomaly is associated with Tertiary continental deposits which are a potential host for sedimentary uranium deposits. Two of the anomalies could be caused by high-uranium-content slates in Paleozoic rocks, but they should be examined to verify this.

7465 (GJBX—113(78)(Vol.2-J)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Talkeetna Mountains Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 203p. Dep. NTIS, PC A10/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the western $^2/_3$ of the Talkeetna Mountains Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed four uranium anomalies worthy of field checking as possible prospects. Two are located over or near Tertiary granite which is believed to have the best potential for future economic uranium deposits. Two other anomalies associated with undifferentiated Mesozoic sediments may be related to acid intrusives or uranium-rich shales. However, they may still have potential as possible uranium prospects.

7466 (GJBX—113(78)Vol.2-K)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Lime Hills Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 195p. Dep. NTIS, PC A09/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Lime Hills Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed 10 uranium anomalies worthy of field checking as possible prospects. Seven are located over (or are suspected of being associated with) granite which is believed to have the best potential for future economic uranium deposits. One anomaly may be caused by high uranium Paleozoic slates, and two others by uranium occurrences underlying Quaternary deposits in the central part of the quadrangle.

7467 (GJBX—113(78)Vol.2-L)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Lake Clark Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 176p. Dep. NTIS, PC A09/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Lake Clark Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed one uranium anomaly that may be worthy of field checking as a possible prospect. However, the abnormally low radioactivity shown by all the rocks in this quadrangle indicates geochemical conditions unfavorable for the formation of economic uranium deposits.

7468 (GJBX—113(78)(Vol.2-M)) **Aerial radiometric and magnetic reconnaissance survey of the Eagle-Dillingham area, Alaska Dillingham Quadrangle.** (Texas Instruments, Inc., Dallas (USA)). Jun 1978. Contract EY-76-C-13-1664. 185p. Dep. NTIS, PC A09/MF A01.

The results of a high-sensitivity aerial gamma-ray spectrometer and magnetometer survey of the Dillingham Quadrangle, Alaska, are presented. Instrumentation and methods are described in Volume 1 of this final report. Statistical and geological analysis of the radiometric data revealed one uranium anomaly worthy of field checking as a possible prospect. It is located over Cretaceous undifferentiated sediments which may have long-range future potential for low-grade sedimentary uranium deposits. The Dillingham Quadrangle does not appear to have appreciable potential for economic uranium deposits of any kind at present. This region shows a marked depletion in radio-element concentrations as compared to world average abundances.

7469 (K/UR—102) **National Uranium Resource Evaluation Program. Hydrogeochemical and stream sediment reconnaissance basic data for Green Bay NTMS Quadrangle, Wisconsin.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Jun 1978. Contract W-7405-ENG-26. 153p. (GJBX—93(78)). Dep. NTIS, MF A01.

Portions of document are illegible.

Field and laboratory data are presented for 695 groundwater samples, 546 stream sediment samples, and 401 stream water samples. Statistical and areal distributions of uranium and other possibly uranium-related variables are displayed. A generalized geologic map of the survey area is provided, and pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed. Greater than 85th percentile concentrations of uranium in all sample types define an area of about 2,000 km^2 (780 mi^2) in the central and north central portions of the survey area as the most probable area for potential uranium mineralization within the quadrangle. Bedrock of the area includes granitic and monzonitic batholiths of Precambrian age. A 500 km^2 area is also outlined by uranium in groundwater samples coincident with a Precambrian fault-shear zone in Marathon County. Anomalous uranium concentrations occur in stream sediments from Marathon, Wood, and Portage Counties; however, other associated variables suggest that the uranium is associated with refractory minerals which are less favorable for commercial potential. Concentrations of uranium above the 85th percentile are also found in Waushara, Winnebago, Outagamie, and Shawano Counties within the area of Cambrian sandstone and Prairie du Chien outcrop. Groundwater and stream water representing the Sinnipee and Ancell Rock Groups, and the Richmond and Silurian Formations are characterized by high conductivity, calcium, magnesium, sulfate, total alkalinity, and pH, but moderate to low concentrations of uranium.

MINING

REFER ALSO TO CITATION(S) 7519

7470 **South African gold and uranium ore mining in 1976.** Hentrich, W. *Erzmetall;* **30**: No. 11, 545-547(Nov 1977). (In German).

1976 was a difficult year for the South African gold and uranium ore mining industry, the region of Witwatersrand (Transvaal province) producing some 75% of all the gold mined in the western world besides being an important producer of uranium oxide. Despite the gold production, declining since 1971, not showing a downward tendency anymore as far as the quantity was concerned, the economic result, however, deteriorated as a consequence of continuously falling gold prices, but also on account of the inflationary rise in wages and the prices for energy and materials. Much higher prices for uranium oxide, which some mines produce as interim products from the 'degolded' slurries of their gold ore leaching plants, improved the economic overall result only to a small degree.

FEED PROCESSING

REFER ALSO TO CITATION(S) 7489, 7519

7471 (IS-M—150) **Control of particle size distribution and agglomeration in continuous ammonium polyuranate precipitation.** Hoyt, R.C.; Burkhart, L. (Ames Lab., IA (USA)). 1978. Contract W-7405-ENG-82. 5p. (CONF-781105—31). Dep. NTIS, PC A02/MF A01. From ANS meeting; Washington, DC, USA (12 Nov 1978).

The results are summarized of the first step in a program to develop a scientific basis for preparing powders with reproducible properties which can be predicted from process operating conditions and can be varied in a systematic fashion to facilitate research in sintering operations and to provide a reliable means of large-scale production with a minimum amount of pellets rejected.

7472 **Process and device for the fabrication of UO_2 uranium oxide using a dry method.** Artaud, R. (to CEA, 75 - Paris (France)). French Patent 2310315/A/. 9 May 1975. 10p. (In French).

This invention concerns a dry process method for the fabrication of UO_2 uranium oxide and a system to use this process. It makes it possible to obtain in a reproducible manner uranium oxide having the requisite physical qualities for easy sintering. The first stage of the process consists in making gaseous uranium hexafluoride with steam in one part of a vessel and the second stage in submitting the UO_2F_2 oxyfluoride obtained in the first stage to a reduction in another part of the same vessel in order to obtain UO_2 uranium oxide.

ENRICHMENT

REFER ALSO TO CITATION(S) 8753

7473 **Uranium enrichment and public policy.** Moore, T.G. Washington, DC; American Enterprise Institute for Public Policy Research (1978). 70p. $2.75.

Alternative policies to the present government monopoly of the uranium enrichment process are discussed in this monograph. Alternative policies analyzed are continued government monopoly and operation by the Department of Energy, establishment of a government corporation, and complete relinquishing of government control with the private sector taking the risks of constructing additional capacity. The material is divided into 6 chapters. Chapter 1 describes the fuel cycle and the public policy issues involved. The enrichment process, current capacity, and the operation of the plants by the government are described in Chapter 2. Chapter 3 estimates future demand for electricity in the U.S. and forecasts the demand for nuclear power and for enrichment services. Chapter 4 describes the historical background, including the Nuclear Fuel Assurance Act, opposition to it, and its demise. The basic policy options the government faces with an analysis of the advantages and disadvantages of each are included in Chapter 5. The final chapter summarizes the findings and presents the conclusion that, from an economic efficiency viewpoint, selling the existing plants and turning the industry over to the private sector would be best. An appendix describes some of the issues involved in plutonium recycling.

7474 Method for removing uranium and beta-decay nuclides. Watanabe, T.; Yoshiwara, K. (to Mitsubishi Metal Corp., Tokyo (Japan)). Japanese Patent 1977-142199/A/. 10 May 1976. 4p. (In Japanese).

Object: To effectively remove uranium and beta-decay nuclides from filtrate of heavy ammonium diuranate slurry discharged from the processing facilities for slightly enriched uranium. Structure: The filtrate contains the beta-decay nuclide whose main constituent comprises uranium and thorium and further contains ammonia and fluorine. Water thorium compound (thorium nitrate, thorium sulfate, and thorium chloride) is added to the filtrate to form a complex ion with the fluorine. Then, water glass is added thereto to simultaneously adsorb and coprecipitate uranium in solution and the complex ion, thus forming a precipitate, which is removed to purify the waste liquid. On the other hand, the precipitate is subject to normal nitrate treatment and further ion exchanging or extraction of solvent to thereby to separate uranium from thorium for recovery.

GASEOUS DIFFUSION

7475 Problems of powder metallurgy in porous barrier fabrication. Szabo Miszenti, G. (Montedison S.p.A., Novara (Italy). Istituto di Ricerche G. Donegani). *Energ. Nucl. (Milan);* **25**: No. 2, 85-91(Feb 1978). (In Italian).

Starting from general considerations on permeable porous systems, the basic features of porous barriers are defined, with particular reference to the uranium isotopic separation by UF_6 gas diffusion. Technological aspects and problems arising from the fabrication of such components are illustrated, in connection with the application of powder metallurgy techniques.

CENTRIFUGATION

7476 Enhancement of centrifuge effect in a plasma with E x B fields. Potanin, E.P.; Karchevskii, A.I.; Ustinov, A.L. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 279-282(Mar 1978).

We consider the enhanced isotope separation due to a countercurrent excited by an axial conductor in a steady-state plasma centrifuge with crossed (radial) electric and (axial) magnetic fields. The magnitude of the circulating flow is estimated in the single-fluid MHD approximation with the compressibility of the gaseous medium taken into account. The concentration distribution of the separated component along the length of the system is calculated from the equation for mass transfer in the column without removal. The enrichment factor K/sub z/ is studied as a function of the compressibility parameter α and the flow intensity V_1.

FUELS PRODUCTION AND PROPERTIES

REFER ALSO TO CITATION(S) 7471, 8590

7477 Alteration in fuel processing at Tokai Works of Mitsubishi Nuclear Fuel Co., Ltd. *Genshiryoku Iinkai Geppo;* **22**: No. 7, 3-8(Sep 1977). (In Japanese).

The report of the Committee on Examination of Nuclear Fuel Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. The alterations are installation of the storage for transport containers containing fuel assemblies, construction of radiation control and other buildings; and improvement and installation of the facilities for chemical-processing, pellet fabrication, fuel assembling, and storage.

7478 Alteration in fuel processing at Tokai Nuclear Fuel Works of Sumitomo Metal Mining Co., Ltd. *Genshiryoku Iinkai Geppo;* **22**: No. 7, 9-10(Sep 1977). (In Japanese).

The report of the Committee on Examination of Nuclear Fuel Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. The alterations are construction of a UF_6 storage building to keep it in vessel as received; and construction of No. 2 powder storage building to raise the storage capacity for UO_2 product and uranium scraps.

7479 Nuclear fuel element. Shimada, M. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1977-101,384/A/. 20 Feb 1976. 2p. (In Japanese).

The object is to impart a sodium-resisting property to a cladding tube for preventing selective effusion of the alloy constituents in the liquid sodium, thereby preventing creation of deterioration in mechanical properties of cladding tube. In a nuclear fuel element, wherein a nuclear fuel material is received into a cladding tube, opposite ends of which are sealed by end plugs, the inner surfaces of the cladding tube comprise a layer of material which produces no swelling by irradiation of fast neutron, whereas the outer surfaces thereof comprise a layer not corroded by liquid metal.

SPENT FUELS REPROCESSING

REFER ALSO TO CITATION(S) 7498, 7500, 7501, 7502, 7503, 7504, 7511, 7517, 7523, 7524, 8231, 8397

7480 (GA-A—15073) Interim development report: engineering-scale HTGR fuel particle crusher. Baer, J.W.; Strand, J.B. (General Atomic Co., San Diego, CA (USA)). Sep 1978. Contract EY-76-C-03-0167-053. 47p. Dep. NTIS, PC A03/MF A01.

During the reprocessing of HTGR fuel, a double-roll crusher is used to fracture the silicon carbide coatings on the fuel particles. This report describes the development of the roll crusher used for crushing Fort-St.Vrain type fissile and fertile fuel particles, and large high-temperature gas-cooled reactor (LHTGR) fissile fuel particles. Recommendations are made for design improvements and further testing.

7481 (GA-A—15092) Dissolution in HTGR fuel reprocessing: interim development report. Yip, H.H.; Olguin, L.J. (General Atomic Co., San Diego, CA (USA)). Aug 1978. Contract EY-76-C-03-0167-053. 102p. Dep. NTIS, PC A06/MF A01.

This interim development report gives the status of the dissolution step involved in reprocessing HTGR reference TRISO-BISO fuels. The information and recommendations presented herein are based on the pilot-plant experimental results obtained at General Atomic Company between September 1975 and May 1978.

7482 (ORNL/TM—6493) Environmental assessment of alterate FBR fuels: radiological assessment of reprocessing and refabrication of thorium/uranium carbide fuel. Tennery, V.J.; Bomar, E.S.; Bond, W.D.; Meyer, H.R.; Morse, L.E.; Till, J.E. (Oak Ridge National Lab., TN (USA)). Aug 1978. Contract W-7405-ENG-26. 83p. AT.

Analysis of the radiation dose due to reprocessing spent (Th,U) carbide fuel plus refabrication of this fuel based on delivery of 50 GW(e)-years of energy allows a direct comparison between the radiological consequences of use of this fuel system and that of other candidates such as (U,Pu) oxide and (U,Pu) carbide. Results for a 1200-MW(e) reactor are expressed in terms of 50-year dose commitments to the maximally exposed individual and to the general population living within 80 km (50 miles) of the operating fuel reprocessing and refabrication plants. For the fuel reprocessing facility, tritium was found to be the principal contributor to total body dose commitment for both the maximally exposed individual and the general population. C-4, Cs-137, and U-232 also contribute significantly to the dose. Maximum individual dose was calculated to be 3.1 mrem (total body) and the population dose was 39.2 man-rem. Both of these doses were derived primarily by ingestion. The maximum individual 50-year dose commitment for the (Th,U) carbide system due to fuel reprocessing is slightly greater than the approximately 2.9 mrem total body dose commitment attendant on use of (U,Pu) carbide or (U,Pu) oxide fuels to produce an equivalent amount of energy in FBRs. For the fuel refabrication plant, the major dose source is the ^{220}Rn daughter, ^{212}Pb, with a maximum total body dose of 0.15 mrem. This dose commitment, although quite low, is about an order of magnitude higher than that associated with (U,Pu) oxide or (U,Pu) carbide fuels to produce an equal amount of energy. Dose commitments to the non-nuclear-worker population from reprocessing and refabricating (Th,U) carbide fuel for use in FBRs are about the same as those associated with recycle of (U,Pu) oxide or (U,Pu) carbide fuels for the same energy production.

7483 (ORNL/TM—6612) **Summary report of TASTEX Task J: resin beam mass spectrometry for safeguards.** Carter, J.A.; Smith, D.H.; Walker, R.L. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 15p. (ISPO—39). Dep. NTIS, PC A02/MF A01.

Our involvement with the TASTEX program is described in Task J; progress on this task during FY-1978 is described. This task involves collaboration with the Japanese at the Tokai reprocessing facility to evolve a sampling scheme suitable for use by International Atomic Energy Agency inspectors. The samples would be taken on resin beads and shipped in that form; because of the small quantities of material involved in this sampling technique, health hazards during transport are eliminated and costs minimized. During a conference at Tokai, the Japanese familiarized us with their reprocessing procedure, and consultations with them led to a sampling protocol that would inconvenience them very little. At Japanese request, we have made measurements and calculations of the amount of radiation from typical beads, and present recommendations as to the number of beads that can safely be handled in a single shipment. Tables of our results are included.

7484 **Spectrophotometric method for the determination of neptunium and plutonium in process solutions.** Vasudeva Rao, P.R.; Patil, S.K. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.). *J. Radioanal. Chem.;* **42**: No. 2, 399-410(1978).

A method is described for the determination of neptunium and plutonium in process solutions. This involves the separation of these elements followed by their spectrophotometric determination as Arsenazo III complexes. Neptunium(IV) and plutonium(IV) are separated using TTA extraction method and the separated Np(IV) and Pu(IV) are then determined as their Arsenazo III complexes in 5 M HNO_3. A few solutions obtained by dissolving irradiated fuels were analysed for plutonium and neptunium using this method and the results were compared with those obtained by other methods. An attempt was made to use Arsenazo III to determine uranium in the plant solutions. The results obtained in all analyses are presented. The values obtained by the spectrophotometric procedure developed in the present work agree well with the values obtained by other methods. In the case of U, however, there is an appreciable positive bias in some values which remains unexplained.

7485 **Safety in alteration of the fuel reprocessing facility of Power Reactor and Nuclear Fuel Development Corporation.** *Genshiryoku Iinkai Geppo;* **22**: No. 7, 2-3(Sep 1977). (In Japanese).

The report of the Committee on Examination of Nuclear Fuel Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. To provide the operational margin in the concentration/denitration of uranium solution, alteration of storage tanks is made. To raise the storage capacity of low-level concentrated liquid wastes, a storage tank is newly installed.

7486 **Radiolytic degradation of extractant-diluent systems used in the Purex process.** Nowak, Z. (Institute of Nuclear Research, Warsaw (Poland)). *Nukleonika;* **22**: No. 2, 155-172(1977).

Extractant - diluent systems used in the Purex-process were degraded radiolytically to study the influence of radiolytic and chemical changes on the extractive properties of the systems studied. Radiolytic degradation of TBP - diluents-nitric acid systems was studied using gas-chromatography, thin-layer radio-chromatography, IR- und UV-spectra and paramagnetic resonance methods. The influence of the dose-rate, the nature of diluent of TBP as well as of nitric acid concentration on extraction of uranium and retention of uranium and zirconium by degraded Purex-solvents was established. It was established that the present methods of solvents clean-up are not effective for heavily degraded solvents.

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 7507, 7511, 7516, 8400

7487 (SAND—78-1118C) **New developments in the air transport of plutonium.** Andersen, J.A. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 28p. (CONF-780924—1). Dep. NTIS, MF A01.

From 9. forum for air cargo; Vancouver, Canada (26 Sep 1978).

Portions of document are illegible.

A new package for the air transport of plutonium has been developed in response to a United States Public Law which restricts the US air transport of plutonium except for small medical devices. This new package, called PAT-1 for plutonium air transportable package model 1, is the result of the NRC-sponsored PARC (plutonium accident resistant container) project at Sandia Laboratories, Albuquerque. The PAT-1 package is designed to meet or exceed new criteria specified in NUREG-0360. These include a severe test sequence of impact (greater than 250 KTS) on an unyielding target, crush, puncture, slash, a large JP-4 fire for 1 hour, followed by water immersion, with stringent acceptance standards on plutonium release, nuclear shielding, and nuclear criticality. The PAT-1 package design features a high energy absorption capability with high-level fire protection. It weighs approximately 227 kg (500 lb) when loaded with 2 kg PuO_2, and can accommodate up to 25 watts thermal energy from the plutonium load.

7488 **Lawsuit concerning ultimate storage in Asse.** *Energiewirtsch. Tagesfragen;* **28**: No. 2, 111-113(Feb 1978). (In German).

The action aimed at ordering the GSF by a temporary injunction in accordance with section 123 of the VwGO not to take or to have taken be third parties irradiated spherical fuel elements from the AVR to the Asse salt mine and to have them stored there irrecoverably, was rejected being inadmissible as with verdict II D 38/77 dated Nov. 2, 1977 by the administrative court at Brunswick. The decision raises the problems resulting from the new version of the Atomic Energy Act on account of the 4th amendment, but leaves open the legal assessment of the underground storage in Asse. The main grounds for rejecting the action are given in full.

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 7470

7489 **Uranium resources and processing.** Vermeulen, L.W. (Rio Algom Mines Ltd., Toronto). pp 5.173-5.181 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Uranium resources and processing are reviewed. Information is included on uranium reserves, uranium consumption, uranium processing and products, enrichment, and exploration.

WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 7269

7490 (BNL-NUREG—24752) **Propertis of solidified radioactive wastes from commercial LWRs.** Neilson, R.M. Jr.; Colombo, P. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 23p. (CONF-780622—70). Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; San Diego, CA, USA (18 Jun 1978).

A study has been performed to characterize the properties of solidified radioactive wastes generated in the liquid radwaste treatment systems at LWRs. The properties which have been studied are those which are pertinent in defining the relative potential for the release of radionuclides to the environment as well as others relating to the evaluation of various solidification agents on an economic and feasibility basis. The use of standard testing procedures in measuring these properties allows an intercomparison of respective properties between various types of solidified waste forms. The leachability, mechanical properties, thermal stability, radiation stability, and thermal properties of hydraulic cement, ureaformaldehyde, bitumen, and addition type polymer waste forms have been measured. In addition, the chemical sensitivity, volumetric efficiency and radiation shielding characteristics of these waste forms have been studied. Emphasis in this paper is placed on the results of studies concerning chemical compatibility of solidification agents with specific waste streams, volumetric efficiency, free standing water, and leachability.

7491 (DOE/EV—0015, pp 101-132) **Decontamination and decommissioning.** Jun 1978.

In Division of Environmental Control Technology program, 1977.

Brief summaries are given of individual projects under the following four programs: management of surplus radioactively contaminated DOE facilities; remedial action at formerly utilized Manhattan Engineer District and Atomic Energy Commission contractor sites; remedial action for inactive uranium mill tailings sites; and Grand Junction remedial action.

7492 (NUREG—0412, pp 20-30) **Credibility issue.** Hoos, I.R. (Univ. of California, Berkeley). Apr 1978.

In Essays on issues relevant to the regulation of radioactive waste management.

One doesn't know whom to believe among the many experts on the disposition of radioactive wastes, and hence he is thrown on naive faith, scientists' and engineers' faith, and fatalistic faith in science and technology. Despite the general faith in disposal in salt beds, geologists have reservations regarding this mode of disposal.

The tendency of some experts to shift the disposal problem to someone else is pointed out. Need for public participation remains. (DLC)

7493 (NUREG—0412, pp 31-46) **Assessment of methodologies for radioactive waste management.** Hoos, I.R. (Univ. of California, Berkeley). Apr 1978.

In Essays on issues relevant to the regulation of radioactive waste management.

No quantitative methodology is adequate to encompass and assess all the risks, no risk/benefit calculation is fine-tuned enough to supply decision-makers with the full range and all of the dimensions. Quality assurance cannot be conceived in terms of systems design alone, but must be maintained vigilantly and with integrity throughout the process. The responsibility of the NRC is fairly well established with respect to overall reactor safety. With respect to the management of radioactive wastes, its mission is not yet so clearly delineated. Herein lies a challenge and an opportunity. Where the known quantitative methodologies are restrictive and likely to have negative feedback effect on authority and public support, the broader lens and the bolder thrust are called for. The cozy cocoon of figures ultimately protects no one. The Commission, having acknowledged that the management of radioactive wastes is not merely a technological matter can now take the socially responsible position of exploring as fully and confronting as candidly as possible the total range of dimensions involved. Paradoxically, it is Charles J. Hitch, intellectual progenitor of the methodology, who observes that we may be missing the meaning of his message by relying too heavily on quantitative analysis and thus defining our task too narrowly. We live in a closed system, in which science and technology, politics and economics, and, above all, social and human elements interact, sometimes to create the problems, sometimes to articulate the questions, and sometimes to find viable solutions.

7494 (NUREG—0412, pp 47-50) **Remarks on managerial errors and public participation.** Hilberry, N. (Univ. of Arizona, Tucson). Apr 1978.

In Essays on issues relevant to the regulation of radioactive waste management.

The failure of the Salt Vault project at Lyons was only a managerial error, as were the leaks in the Hanford tanks. Administrative and managerial decision-making needs to be distinguished. Despite claims to special welfare for the public welfare, no segment of the public, such as environmentalist groups, should be permitted to exercise greater (or lesser) political pressure than any other segment. The US NRC Commissioners should be the personification of the public for all operational purposes. (DLC)

7495 (NUREG—0412, pp 51-59) **Observations and impressions on the nature of radioactive waste management problems.** Bishop, W.P. Apr 1978.

In Essays on issues relevant to the regulation of radioactive waste management.

The observations and impressions of the NRC Task Group on the goals of radioactive waste management fall into five basic categories: (1) Perceptions of the waste management problem; (2) hazards of radioactive wastes; (3) methodology for assessing radioactive waste management; (4) decision processes in waste management; and (5) problems of implementing a waste management system. Each category is discussed. (DLC)

7496 (NUREG—0412, pp 60-94) **Goals for nuclear waste management.** Watson, R.A. (Washington Univ., St. Louis, MO). Apr 1978.

In Essays on issues relevant to the regulation of radioactive waste management.

Establishing a publicly, politically, economically, and technologically acceptable waste management system for the fuel cycle is a necessary condition for accepting the nuclear program as a national energy option. Findings are given on the technology, politics, economics, morality, aesthetics, and societal impact of waste management. Proposed goals are outlined for the regulation of waste management. (DLC)

7497 (UCRL—52404) **Determination of acceptable risk criteria for nuclear waste management.** Cohen, J.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1977. Contract W-7405-ENG-48. 71p. Dep. NTIS, PC A04/MF A01.

The initial phase of the work performed during FY 1977 consisted of performing a "scoping" study to define issues, determine an optimal methodology for their resolution, and compile a data base for acceptable risk criteria development. The issues, spanning technical, psychological, and ethical dimensions, were categorized in seven major areas: (1) unplanned or accidental events, (2) present vs future risks, (3) institutional controls and retrievability, (4) dose-response mechanism and uncertainty, (5) spatial distribution of exposed populations, (6) different types of nuclear wastes, and (7) public perception. The optimum methodology for developing ARC was determined to be multi-attribute decision analysis encompassing numerous specific techniques for choosing, from among several alternatives, the optimal course of action when the alternatives are constrained to meet specified attributes. The data base developed during the study comprises existing regulations and guidelines, maximum permissible dose, natural geologic hazards, nonradioactive hazardous waste practices, bioethical perspectives, and data from an opinion survey.

7498 **Management of radioactive wastes from reprocessing operations.** Clelland, D.W. (British Nuclear Fuels Ltd., London). pp 64-72002 2/3 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

The paper summarizes the extensive experience gained in the U.K. over 25 years in the reprocessing of spent fuels from thermal nuclear power reactors and from dealing with the radioactive wastes. The amounts and forms of all wastes are given, with present and future management plans outlined. The risks from public exposure to the low levels of radioactivity released to the environment are examined and put into perspective. High-level waste management is dealt with in particular detail and is demonstrated as giving rise to one centimeter cube of glass containing half gram fission products per person supplied with entirely nuclear electricity over a year, the very compact form enabling the highest standards of processing, containment and isolation to be employed. Total release of radioactivity to the environment from the nuclear power cycle are examined and shown controlled to very low levels, constituting only very small additions to the natural background levels. Variation due to different modes of living in different localities are demonstrated as very much more important than exposure from present or future radioactive waste disposal. Finally, risks from nuclear power generation and radioactive waste disposal are interpreted in terms of risks to the public and shown very much less than those occurred in most common everyday activities. If the present U.K. nuclear industry is expanded ten times to supply all present electricity requirements, the risk of death from disposal of nuclear wastes is about five times less than that of being killed by lightning.

7499 **Protokoll ueber die oeffentliche Anhoerung zu Fragen des Umweltschutzes: Entsorgung von Kernkraftwerken. Protokoll Nr. 25 und 26. (Minutes of the public hearing concerning questions of environmental protection: nuclear power plant waste management. Minutes No. 25 and 26).** Bonn, Germany, F.R.; Heger (1977). 241p. (In German).

Minutes of questions of members of the Bundestag addressed to experts of the pro and con camp, of answers and of written statements on the following central subjects: Concept of waste management; fuel cycle centers; technology of fuel reprocessing plants; safety.

WASTE PROCESSING

REFER ALSO TO CITATION(S) 7474, 8231, 8648

7500 (CONF-781105—41) **Remotely replaceable and testable off-gas filter system for the NWCF.** May, K.W.; Loo, H.H. (Allied Chemical Corp., Idaho Falls, ID (USA)). 1978. Contract EY-76-C-07-1540. 18p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The process off-gas filter system designed for use in the New Waste Calcining Facility (NWCF) requires remote filter removal, replacement and in-place DOP testing. A series of full-scale mockup tests, modifications and retesting at the Remote Maintenance Development Facility (RMDF) resulted in a system in which a commercial High Efficiency Particulate Air (HEPA) filter can be installed, tested for leaks, operated and removed from a sealed filter housing using remote handling methods. This paper describes the development, testing and results of this effort.

7501 (CONF-781105—42) **Remote process connectors for the NWCF.** Jacobs, R.T.; Carter, J.A.; Hohback, A.C. (Allied Chemical Corp., Idaho Falls, ID (USA)). 1978. Contract EY-76-C-07-1540. 30p. Dep. NTIS, PC A03/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The remote process connectors developed, used, and tested at the Remote Maintenance Development Facility are described. These connectors, including the 3-bolt kinematic-graphite flange and watertight-electrical connectors, are assembled on master jigs (holding-welding fixture) to form interchangeable pump and valve loop assemblies. These assemblies, with their guide-in platforms make possible a method of performing remote maintenance at the New Waste Calcining Facility that is a departure from methods which until now have been the standard of the industry.

7502 (CONF-781105—43) **Remote design criteria and philosophy of the New Waste Calcining Facility.** Bingham, G.E.; Wheeler,

B.R. (Allied Chemical Corp., Idaho Falls, ID (USA)). 1978. Contract EY-76-C-07-1540. 22p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

A New Waste Calcining Facility is being built at the Idaho Chemical Processing Plant to replace the existing Waste Calcining Facility which was built to demonstrate fluidized-bed solidification of highly radioactive liquid wastes. The new facility will include significant remote features and provisions for effecting major reductions in the annual personnel radiation exposures being experienced at the Idaho Chemical Processing Plant. Past Chemical Processing Plant equipment failure histories and personnel radiation exposure histories are described along with corrective actions being taken in the new facility to reduce exposures and the anticipated results of those actions.

7503 (CONF-781105—44) **Remotely replaceable fuel and feed nozzles for the NWCF calciner vessel.** Fletcher, R.D.; Carter, J.A.; May, K.W. (Allied Chemical Corp., Idaho Falls, ID (USA)). 1978. Contract EY-76-C-07-1540. 15p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The development and testing of remotely replaceable fuel and feed nozzles for calcination of liquid radioactive wastes in the calciner vessel of the New Waste Calcining Facility (NWCF) being built at the Idaho National Engineering Laboratory are described. A complete fuel nozzle assembly was fabricated and tested at the Remote Maintenance Development Facility to evolve design refinements, identify required support equipment, and develop handling techniques. The design also provided for remote replacement of the nozzle support carriage and adjacent feed and fuel pipe loops using two pairs of master-slave manipulators.

7504 (CONF-781105—45) **Integrated remote process sampling system for the NWCF.** Jacobson, M.E.; Loo, H.H. (Allied Chemical Corp., Idaho Falls, ID (USA)). 1978. Contract EY-76-C-07-1540. 23p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Increased emphasis on lowering personnel radiation exposures to as-low-as-reasonably-achievable (ALARA) and on containment of radioactive materials influenced a special emphasis on remotely operated sampling systems for the New Waste Calcining Facility (NWCF). This paper describes work done by Allied Chemical Corporation in designing and testing remote solid, liquid and gas sampling systems for the NWCF. Work also included a transfer system for transferring samples to an analytical facility. Remote maintenance capabilities were designed into the system so that any failure prone component or subassembly could be remotely removed and replaced.

7505 (DP-MS—78-5) **Radiation-induced iodine migration in silver zeolite beds.** Evans, A.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1978. Contract EY-76-C-09-0001. 13p. (CONF-780819—5). Dep. NTIS, PC A02/MF A01.

From 15. nuclear air cleaning conference; Boston, MA, USA (Aug 1978).

The radiation stability of iodine-loaded, silver-exchanged zeolite (AgX) was evaluated under dynamic flow conditions. Three tests were conducted in which 1-in.-deep beds of 10 x 16 mesh AgX beads were loaded to approximately 6 mg ^{131}I-tagged elemental iodine per mg AgX over a 1-h period. Test conditions included an intense radiation field (absorbed dose rate of approximately 1.5 x 10^7 rads/h), a steam-air mixture (80°C and 95 percent relative humidity) and a face velocity of 55 ft per minute. Iodine passing through the beds was collected on backup beds located outside the radiation field to determine the penetration occurring during the irradiation period. Two additional tests were conducted at I_2 loadings of approximately 0.6 mg/g and an exposure period of 5 h. The test bed was loaded with AgX in one test and with GX-176 carbon in the other test to determine the spatial distribution of I_2 at a lighter loading. The long-term test (105-h exposure) showed that little iodine migration occurred after approximately 1.6 x 10^9 rads (cumulative penetration of ^{131}I was 0.7 percent for the entire test). More than 30 percent of the iodine activity remaining on the bed was located in the downstream half of the bed. About 3.9 percent of the iodine migrated to the last 1/8-in. section of the bed. Comparison of activity distributions after short-term and long-term irradiation indicates that up to 10 percent of the iodine was redistributed within the bed after prolonged exposure to intense radiation and flowing air. However, downstream migration from radiolytic decomposition of silver-iodine complexes is less important to the iodine distribution than is the rapid heavy loading.

7506 (EUR—5690) **Prediction for the high-level alpha-active waste to be generated by nuclear power stations in the Member States of the European Communities.** Schmidt, E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). Apr 1977. 20p. Dep. NTIS (US Sales Only), PC A02/MF A01.

Starting with a forecast for the nuclear power generating capacity to be installed in the Member States of the European Communities before the end of this century, a prediction is made of the annual production of high-level alpha-active waste from reprocessing plants and the corresponding accumulation up to the year 2000. The isotopic composition of the alpha-active waste from individual reactor types was calculated and an estimation of the influence of recycling plutonium through light water reactors on the produced quantity of higher actinides is made.

7507 (ICP—1161) **Product removal and solids transport from fluidized-bed calciners.** Grimmett, E.S.; Munger, D.H. (Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office). Sep 1978. Contract EY-76-C-07-1540. 37p. Dep. NTIS, PC A03/MF A01.

Methods of removing the solid product from pilot-plant and production fluidized-bed calciners, and transporting product to underground storage vaults are reported here. Testing of dense-phase solids transport systems in test loops during development of a 15-cm-diam. and 30-cm-diam. calciner are described. A lean-phase solid transport system is used with the Waste Calcining Facility. The results of some recent tests done in a lean-phase transport system connected to the 30-cm-diam. calciner are included in this report.

7508 **Equilibration studies of an inorganic ion exchange material with liquid nuclear waste simulant using radiotracer techniques.** Merrill, R.M.; Harrison, P.E. (Sandia Labs., Albuquerque, N.Mex. (USA)). *J. Radioanal. Chem.;* **43**: No. 1, 93-100(1978).

Ion exchange distribution coefficients of zirconium, ruthenium, europium and strontium elements found in high level nuclear waste were determined for a new titanium hydrous oxide-type inorganic ion-exchange compound. The material is prepared by reactions of a metal alkoxide [$Ti(OC_3H_7)_4$] with an alcoholic solution of sodium hydroxide followed by hydrolysis: NaOH (methanol) + $Ti(OC_3H_7)_4$ → Intermediate. Intermediate + H_2O → $Na[Ti_2O_5H]$(solid) + C_3H_7OH. The titanate exchange material has a high affinity for all polyvalent cations present in nuclear wastes, has a high capacity, and reacts with the wastes to produce a material which may be consolidated into leach resistant ceramics. Coefficients were determined at ambient temperatures and at 85°C. The equilibrations were done in solutions simulating the composition of nuclear waste expected from the Allied General Nuclear services, Barnwell, South Carolina plant. The progress of each reaction was monitored by adding a radiotracer of the element investigated to the simulated waste solution. Ambient temperature distribution coefficients ranging from a high level of 1.2 . 10^6 for Zr to a low level of 58 for Eu were obtained when equal weights of ion exchange material were used. Significantly higher distribution coefficients were found at 85°C than at ambient temperatures.

7509 **Exhaust vapour separator.** Stuermer, H. (to Steinmueller (L. u. C.) G.m.b.H., Gummersbach (Germany, F.R.)). German(FRG) Patent 2,618,872/A/. 17 Nov 1977. 7p. (In German).

A suggestion is made to connect a centrifugal separating device with a drive, outside the vapour separator, to a waste vapour separator for the separation of radioactive liquid wastes in a nuclear reactor.

7510 **Characteristics of iodine removal by charcoal filter and their safety evaluation.** Kobayashi, S.; Takashima, Y. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor). *Nippon Genshiryoku Gakkaishi;* **19**: No. 10, 702-708(Oct 1977). (In Japanese).

There have been a number of studies on the removal of radioactive iodine using several kinds of adsorbents. However, there are few reports on the variation of removal efficiency with the time considering the saturation of iodine in the adsorbent. The adsorption rate has been often assumed to be controlled by the fluid film resistance, and the adsorption mechanism has been explained simply by neglecting the time dependence. This paper presents the iodine adsorption characteristics by a charcoal filter which are obtained from a numerical calculation, taking into account the diffusion process inside of a porous particle. As the result, the iodine concentration at the outlet of the charcoal filter could break through from a certain time and then change with the time variously depending on the operating condition. It was found that the adsorption rate is controlled by the intraparticle resistance rather than by the fluid film resistance.

7511 **Disposal of radioactive waste produced by nuclear power plant.** Despotovicj, R.; Suboticj, B. (Institut Rudjer Boskovicj, Zagreb (Yugoslavia)). pp 427-431 of Proceedings of 9. symposium of Yugoslav radioactive protection association. Jajce; JDZZ (1977). (In Serbian)

Paper deals with technological problems of treatment, transport and the disposal of radioactive wastes, with accent on radioactive waste obtained during the production of electricity. In regard to the present discussion about program which calls for a number of power plants to be introduced in Yugoslav electroenergy system, the paper discusses a problem of radioactive waste produced by the present technological process for the production of electrical energy.

A special attention is paid to the problem of recycling nuclear fuel. Review is based on extensive available data, especially relative to the disposal of large quantities of radioactive waste produced in the near future.

7512 (ORNL-tr—4576) **Separation of transuranium elements from high-activity wastes of reprocessing of nuclear fuels.** Bathellier, A.; Guillaume, B.; Moulin, J.P. (CONF-770354—2). (Oak Ridge National Lab., TN (USA)). 1977. Translated by R. G. Mansfield from pp 129-145 of Technical Meeting on Nuclear Transmutation of Actonites, Ispra, Italy, March 16-18, 1977. 36p. Dep. NTIS, PC A03/MF A01.

In order to evaluate the performances required for this separation, calculations have been made by taking into account the properties of the glass designed to confine the wastes and values of the CMA for the various isotopes concerned. Although separation by precipitation cannot be refected a priori, we have directed our efforts towards solvent extraction. Various schemes have been considered.

7513 **Device for filling a drum with radioactive wastes.** Wase, K. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1977-100,100/A/. 18 Feb 1976. 3p. (In Japanese).

Object: To provide a buffle at a lower portion within a hopper to form an annular outlet opening, thereby preventing pellets charged from being one-sided toward the center of a drum can and reducing in size gaps due to the angle of repose to increase a filling quantity. Structure: Pellets coveyed by a conveyor drop into a hopper. The hopper is secured to a frame, and has a conical buffle mounted in the central portion at the lower end thereof. The buffle is retained on a center line of the drum by means of a plurality of arms, and the outlet opening of the hopper assumes an annular configuration. The dropped pellets once impinge upon the buffle and pass through the outlet opening and then accumulated at a position of a concentric cylinder of the drum can. The use of this device results in smaller gaps and in a greater filling quantity.

WASTE DISPOSAL AND STORAGE

REFER ALSO TO CITATION(S) 7485, 7488, 7511

7514 (DOE/EV—0015, pp 71-99) **Nuclear energy.** Jun 1978. In Division of Environmental Control Technology program, 1977.

Nuclear energy studies supported under DOE contracts consisted of: assessment of the environmental aspects of alternative nuclear fuel cycles; assessments of long-term waste management concepts including investigation of the environmental feasibility of deep ocean bed disposal; and development of methods for assessing the adequacy of environmental protection afforded by DOE nuclear energy material shipping containers. Nineteen individual projects are briefly summarized. (LK)

7515 (TREE—1277) **Selection of a criticality monitoring technique for a transuranic waste incinerator.** Nieschmidt, E.B.; Vegors, S.H. Jr. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1978. Contract EY-76-C-07-1570. 47p. Dep. NTIS, PC A03/MF A01.

Active and passive monitoring techniques were studied and compared for determining the amount of fissile material in transuranic (TRU) waste before and after the waste is incinerated. The passive counting techniques investigated were gamma ray, neutron, x-ray, and alpha. The active interrogation techniques investigated were thermal neutron, fission neutron, fast neutron, and photon. Results indicate that the photon interrogation method should be the best technique for criticality monitoring of the TRU waste flowing into and out of the slagging pyrolysis incinerator. This technique is based on utilization of high-energy photons (5 to 10 MeV) to cause fission of the fissile material in the waste. These photons are produced when high energy electrons from a linear accelerator strike a target. When fission occurs, prompt and delayed neutrons and gamma rays are produced. The prompt neutrons are then counted and related to fissile material content.

7516 (Y/OWI/SUB—78/22340/2) **U.S. working draft on repository physical descriptions in a granite formation.** (Science Applications, Inc., Oak Ridge, TN (USA); Dames and Moore, Oak Ridge, TN (USA); Parsons-Brinckerhoff, New York (USA)). May 1976. Contract W-7405-ENG-26. 100p. Dep. NTIS, PC A05/MF A01.

This report presents a physical description of a reference deep-geologic repository located in a granite host rock at a depth of about 1500 meters. Two reference repository designs are described in this report. One is designed to accept wastes from a lightwater reactor (LWR) strategy in which no reprocessing occurs, and the spent fuel itself is considered a waste form. The second is designed to accept wastes from an LWR strategy with reprocessing in which uranium and plutonium are recycled.

7517 **Concept of the German electric power industry for the disposal of spent fuel from nuclear power plants.** Salander, C. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). *Kerntechnik;* **20**: No. 5, 229-237(May 1978). (In German, English).

From Conference on the problems of radioactive wastes in nuclear technology; Essen, Germany, F.R. (20 Oct 1977).

The following report describes the German concept for the disposal of spent nuclear fuel elements. The Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen (DWK) was founded by German utilities to realize the project, which was originally initiated by the Federal Government as an integrated Centre for the Disposal of Spent Fuel. In this centre all installations, fuel element storage, reprocessing, re-use of uranium and plutonium, and final storage of wastes, are concentrated at one site.

7518 **Radioactive waste disposal and storage plant in Hungary.** Osztrovszki, G. (Orszagos Atomenergia Bizottsag, Budapest (Hungary)). *Energ. Atomtech.;* **30**: No. 10, 433-437(Oct 1977).

According to the increasing quantity of radioactive wastes, the establishment of a waste disposal and storage plant has become up-to-date in Hungary. The main aspects of the realization and the ways of waste disposal and storage are discussed. The selection of the plant location was made on the basis of the following aspects: the presence of an impermeable layer, the price of the public utility works and the distance of the plant from Budapest. The capacity of the equipment was estimated. Depending on their quality and specific activity the collected wastes are placed directly in receivers or they are previously processed (flocculation, ion-exchange, filtration, solidifying). The main parts of a plant constructed in Hungary in the previous year are described: inactive official building, technological building for waste disposal and various types of receivers.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 7482, 8883

7519 (ORNL/TM—6474) **Environmental assessment of alternate FBR fuels: radiological assessment of airborne releases from thorium mining and milling.** Tennery, V.J.; Bomar, E.S.; Bond, W.D.; Morse, L.E.; Meyer, H.R.; Till, J.E.; Yalcintas, M.G. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 131p. AT.

Results are presented of a radiological analysis of the impact of thorium ore mining and milling from vein deposits at two specific sites, one in the Lemhi Pass district of Idaho and Montana and the other in the Wet Mountains of Colorado. Principal airborne radionuclides which contribute to the population dose commitment for either site are ^{228}Ra and ^{220}Rn plus the daughters of ^{220}Rn. Total-body dose commitments to the maximally exposed individual for one year of facility operation for the Lemhi Pass and Wet Mountains sites are approximately 2.4 and approximately 3.5 millirems respectively. Population dose commitments to total body for the Lemhi Pass and Wet Mountains sites are 0.05 and 0.3 man-rem respectively. For both sites and both types of dose commitment, inhalation and ingestion are the largest pathway contributors to the dose. Several operations for thorium ore mining and milling were identified during this assessment for which the data base required for radionuclde source term generation was either small or nonexistent. For operations where the data base was judged insufficient for generation of at least a first-approximation source term, data appropriate to the similar operation for uranium mining or milling were used as the basis for the source term. Areas where data needs are greatest include (1) quantitative values of emanation factors and diffusion coefficients for ^{220}Rn for thorium ore materials, (2) fugitive dust generation rates from mine activities and thorium ore piles, (3) release rates of ^{220}Rn from thorium ores under various storage conditions, (4) release rates of ^{220}Rn from thorium ores for various milling milling process treatments, (5) properties of soils in mountainous locations of vein-type thorium deposits to determine their suitability for construction of tailings ponds and retention of radioactive species contained in the mill tailings, and (6) site-specific meteorology appropriate to prime candidate sites for thorium mines and mills.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7477, 7478, 7485, 7502, 7515

REGULATIONS

ACCOUNTABILITY AND SAFEGUARDS

REFER ALSO TO CITATION(S) 7483, 8131

7520 (CONF-780622—66) **Suggested non-proliferation criteria for commercial nuclear fuel cycles.** Laney, R.V.; Heubotter, P.R. (Argonne National Lab., IL (USA)). 12 Jan 1978. Contract W-31-109-ENG-38. 15p. Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; San Diego, CA, USA (18 Jun 1978).

Based on the Administration's policy to prevent nuclear weapons proliferation through diversion of fuel from commercial reactor fuel cycles, a "benchmark" set of nonproliferation criteria was prepared for the commercial nuclear fuel cycle. These criteria should eliminate incremental risks of proliferation beyond those inherent in the present generation of low-enriched-uranium-fueled reactors operating in a once-through mode, with internationally safeguarded storage of spent fuel. They focus on the balanced application of technical constraints consistent with the state of the technology, with minimal requirements for institutional constraints, to provide a basis for assessing the proliferation resistance of proposed fission power systems. The paper contains: (1) our perception of the nuclear energy policy and of the baseline proliferation risk accepted under this policy; (2) objectives for a reactor and fuel cycle strategy which address the technical, political, and institutional aspects of diversion and proliferation and, at the same time, satisfy the Nation's needs for efficient, timely, and economical utilization of nuclear fuel resources; (3) criteria which are responsive to these objectives and can therefore be used to screen proposed reactor and fuel cycle strategies; and (4) a rationale for these criteria.

7521 (KFK—2319) **Employment of a completely automated mass spectrometer in fissile material control.** Wilhelmi, M.; Brandalise, B.; Koch, L.; Rijkeboer, C.; Romkowski, M. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Radiochemie; Kernforschungszentrum Karlsruhe (Germany, F.R.). Projekt Spaltstoffflusskontrolle; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). Mar 1977. 107p. (In German). (EUR—5504d). Dep. NTIS (US Sales Only), PC A06/MF A01.

The demand for higher accuracy and a shorter delay in the analysis together with better objectifiability and data security needed in safeguards, lead to the automation of a mass spectrometer. Starting with a continuous feeding of samples via a high vacuum lock and including the subsequent heating, focussing and scanning of the samples as well as the final evaluation of the source data (taking alpha spectrometry and the weights required for the isotope dilution technique into account), the mass spectrometric procedure was completely automated. For this purpose, a serial CH-5 instrument of VARIAN MAT was modified to be operated by a VARIAN 620/I computer. A newly developed three chamber high vacuum lock was attached to this system and the final evaluation is made with an IBM 370. The system has been used in operation for the isotope analysis of U, Pu and Nd for one year. Major breakdowns of the hardware did not occur, however, the computer programmes had to be steadily improved according to the changing characteristics of the samples. Compared to manual operation, the automat is superior in its throughput and speed of analysing series of similar samples. The automatic procedure objectifies the analysis and the complete evaluation ensures a better data security.

7522 (RFP—2757) **New approach for safeguarding enriched uranium hexafluoride bulk transfers.** Doeher, L.W.; Pontius, P.E.; Whetstone, J.R. (Atomics International Div., Golden, CO (USA). Rocky Flats Plant; National Bureau of Standards, Washington, DC (USA). Center for Mechanical Engineering and Process Technology). 1978. Contract EY-76-C-04-3533. 15p. (IAEA-SM—231/68; CONF-781007—7). Dep. NTIS, PC A02/MF A01.

From IAEA symposium on nuclear material safeguards; Vienna, Austria (2 Oct 1978).

The unique concepts of American National Standard ANSI N15.18-1975 "Mass Calibration Techniques for Nuclear Material Control" are discussed in regard to the establishment and maintenance of control of mass measurement of Uranium Hexafluoride (UF_6) both within and between facilities. Emphasis is placed on the role of control of the measurements between facilities, and thus establish decision points for detection of measurement problems and making safeguards judgments. The unique concepts include the use of artifacts of UF_6 packaging cylinders, calibrated by a central authority, to introduce the mass unit into all of the industries' weighing processes. These are called Replicate Mass Standards (RMS). This feat is accomplished by comparing the RMS to each facility's In-House Standards (IHS), also artifacts, and thence the usage of these IHS to quantify the systematic and random errors of each UF_6 mass measurement process. A recent demonstration, which exchanged UF_6 cylinders between two facilities, who used ANSI N15.18-1975 concepts and procedures is discussed. The discussion includes methodology and treatment of data for use in detection of measurement and safeguards problems. The discussion incorporates the methodology for data treatment and judgments concerning (1) the common base, (2) measurement process off-sets, (3) measurement process precision, and (4) shipper-receiver bulk measurement differences. From the evidence gained in the demonstration, conclusions are reached as to the usefulness of the realistic criteria for detection of mass measurement problems upon acceptance of the concepts of ANSI N15.18-1975.

7523 (UCID—17935) **Performance model for a CCTV-MTI.** Dunn, D.R.; Dunbar, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1978. Contract W-7405-ENG-48. 38p. Dep. NTIS, PC A03/MF A01.

CCTV-MTI (closed circuit television—moving target indicator) monitors represent typical components of access control systems, as for example in a material control and accounting (MC and A) safeguards system. This report describes a performance model for a CCTV-MTI monitor. The performance of a human in an MTI role is a separate problem and is not addressed here. This work was done in conjunction with the NRC sponsored LLL assessment procedure for MC and A systems which is presently under development. We develop a noise model for a generic camera system and a model for the detection mechanism for a postulated MTI design. These models are then translated into an overall performance model. Measures of performance are probabilities of detection and false alarm as a function of intruder-induced grey level changes in the protected area. Sensor responsivity, lens F-number, source illumination and spectral response were treated as design parameters. Some specific results are illustrated for a postulated design employing a camera with a Si-target vidicon. Reflectance or light level changes in excess of 10% due to an intruder will be detected with a very high probability for the portion of the visible spectrum with wavelengths above 500 nm. The resulting false alarm rate was less than one per year. We did not address sources of nuisance alarms due to adverse environments, reliability, resistance to tampering, nor did we examine the effects of the spatial frequency response of the optics. All of these are important and will influence overall system detection performance.

7524 **Methods for the verification of input analysis in reprocessing nuclear fuel.** Koch, L. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). *J. Radioanal. Chem.;* **42**: No. 2, 359-366(1978). (In German).

The established reprocessing input analysis methods (Pu/U ratio- and volume/concentration methods) are compared with two isotope correlation techniques based on heavy isotopes and fission gas nuclides. The potential of the latter for the verification of reprocessing input data is demonstrated covering various aspects such as accuracy, intrusiveness, additional effort, independence of plant operations, reliability etc. The correlation techniques have the advantage that only one isotope ratio is to be measured; e.g. $^{241}Pu/^{242}Pu$ or $^{84}Kr/^{83}Kr$. The isotope concentration of ^{240}Pu can be calculated on the basis of a single correlation. The $^{84}Kr/^{83}Kr$ ratio is even not influenced by plutonium feedback. By this way measurements of volume and density as well as isotope dilution can be avoided. The only drawback is the somehow larger statistical deviation of the results.

7525 **Proliferation-resistant nuclear fuel cycles.** Feiveson, H.A. (Princeton Univ., NJ). *Annu. Rev. Energy;* **3**: 357-394(1978).

Recent studies on the ways in which different reactor types and fuel-cycle practices can affect the risks of nuclear proliferation by states are reviewed. Proliferation resistance of alternative fuel cycles, qualities of proliferation resistance, and economics of alternative fuel cycles are discussed. 56 references.

ADMINISTRATIVE AND REGULATORY

7526 (CONF-771155—P1, pp 19-30) **Global proliferation concerns.** Simpkins, R. Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

The Non-Proliferation Treaty and the IAGA Safeguards System are discussed. President Carter's program to defer commercial reprocessing and recycle, to restructure the breeder program, to develop alternative fuel cycles, to increase US uranium enrichment capability, to provide fuel assurance for consumer nations, to continue the embargo of sensitive technology and equipment and to develop the International Nuclear Fuel Cycle Evaluation Program is outlined.

FUSION FUELS

SOURCES

7527 Lithium for thermonuclear fusion reactors. Barrett, W.T.; Kunasz, I.A. (Foote Mineral Co., Exxon, PA). pp 5.182-5.185 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The technology of tritium production from lithium for thermonuclear reactor fuels is discussed. Information is included on lithium raw materials, lithium metal, lithium chemicals, and North American reserves of lithium minerals. (JRD)

BY-PRODUCTS

REFER ALSO TO CITATION(S) 7543

7528 (BNL—24625) **Hydrogen production from fusion reactors coupled with high temperature electrolysis.** Fillo, J.A.; Powell, J.R.; Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). [nd]. Contract EY-76-C-02-0016. 35p. (CONF-780807—9). Dep. NTIS, PC A03/MF A01.

From 2. world hydrogen energy conference; Zurich, Switzerland (21 Aug 1978).

The decreasing availability of fossil fuels emphasizes the need to develop systems which will produce synthetic fuel to substitute for and complement the natural supply. An important first step in the synthesis of liquid and gaseous fuels is the production of hydrogen. Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Processes which may be considered for this purpose include electrolysis, thermochemical decomposition or thermochemical-electrochemical hybrid cycles. Preliminary studies at Brookhaven indicate that high temperature electrolysis has the highest potential efficiency for production of hydrogen from fusion. Depending on design electric generation efficiencies of approximately 40 to 60 percent and hydrogen production efficiencies of approximately 50 to 70 percent are projected for fusion reactors using high temperature blankets.

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

PHYSICAL ISOTOPE SEPARATION

7529 Isotope enrichment by resonance trapping. Silfvast, W.T. (to Bell Telephone Labs., Inc.). US Patent 4,101,396. 18 Jul 1978. Filed date 23 Dec 1976. 10p.

A photochemical method for changing the isotopic composition of an element is disclosed. The method involves passing an electron discharge through a mixture of a buffer gas, which controls the uniformity and electron temperature of the discharge, and a vapor of the element. By means of the phenomenon of resonance radiation trapping, the electron discharge preferentially excites and ionizes one isotope. Removal of the ions by cataphoresis separates the element into two amounts with different isotopic ratios.

7530 Isotopically enriched helium-4. Garwin, L. US Patent 4,101,375. 18 Jul 1978. Filed date 17 Nov 1975. 10p.

The invention relates to a method of producing isotopically enriched ^{4}He. It is produced from a liquefied natural gas source.

7531 Process for the separation of gas mixtures into component fractions according to their molecular or atomic weight. Wikdahl, N.A.L. US Patent 4,092,130. 30 May 1978. Filed date 31 Mar 1976. 16p.

A process is provided for separation of gas mixtures into component fractions according to their molecular or atomic weight. The mixture is subjected to the centrifugal force applied in a cone-shaped vortex having a diameter of not over 5 mm at a gas feed absolute pressure from about 5 to about 1000 mm of mercury, and a pressure ratio within the range from about 1.5 to about 10. In the case where an inert gas is used in admixture with the gas mixture, the gas feed pressure can exceed 1000 mm of mercury, and gas inlet and outlet pressures can range up to the liquefaction pressure of any gas in the mixture at the operating temperature. The higher molecular or atomic weight fractions are separated from an outer or peripheral portion of th vortex, and the lower molecular or atomic weight fractions are separated from an inner or core portion of the vortex.

HEAVY WATER PRODUCTION

7532 Process for the production of hydrogen/deuterium-containing gas. Nitschke, E.: Desai, A.; Ilgner, H. (to Friedrich Uhde GmbH). US Patent 4,101,645. 18 Jul 1978. Filed date 8 Nov 1976. 8p.

A process for the production of hydrogen/deuterium-containing gas is described in which the enriched condensate obtained from the production of a hydrogen/deuterium-containing gas mixture is collected and subjected to a direct exchange of isotopes with the feedsteam admitted to the process. Such condensate can be brought into direct exchange of isotopes with the gas water vapor mixture within the process, viz. ahead of the CO conversion section. The exchange of isotopes may be performed according to the countercurrent principle. If it is intended to maintain in the hydrogen/deuterium-containing gas a certain definite content of water vapor whose phase condition is superior to the condition achieved when using normal cooling water, this gas, at least 0.6 kg/m^3 of gas, is subjected to an exchange of isotopes with the water fed additionally into the process.

RADIATION SOURCES

REFER ALSO TO CITATION(S) 8827

7533 Simple determination of the dose-rate at point in water around linear radioactive sourse. Takada, T. (Kyushu Univ., Fukuoka (Japan). Faculty of Medicine). *Nippon Hoshasen Gijutsu Gakkai Zasshi;* **33**: No. 4, 433-437(Nov 1977). (In Japanese).

A simple formula giving the dose rate in water around linear radioactive source is presented. The formula was based on modified Sivert's formula. The calculated value was compared with several author's datas or experimental value, the results were as follows: 1) the maximum error between the calculated dose rate for ^{226}Ra source and Uchiyama's date was less than 10 percent. 2) agreement between calculated and measured attenuation curves with distance from Ra source was seen to be similar in shape. 3) agreement between the calculated dose distribution around ^{137}Cs source and Klvenhagen's data was seen to be similar.

OTHER INDUSTRIAL USES

REFER ALSO TO CITATION(S) 8775

7534 (SAND—78-0242) **Beneficial uses program. Progress report, period ending September 30, 1977.** (Sandia Labs., Albuquerque, NM (USA)). Jun 1978. Contract EY-76-C-04-0789. 30p. Dep. NTIS, PC A03/MF A01.

The Beneficial Uses Program develops the necessary technologies for cost/beneficial uses of existing and future surplus radioactive isotope materials. The major amount of work has been concentrated on two subprograms, the Waste Resources Utilization Program and the Separation Technology and Source Development Program. Most of the working time in the Waste Resources Utilization Program is now spent studying dried raw or composted sludges. This is in response to rapidly developing composting technology and its increasing potential use as an alternative to landfilling and ocean dumping. The greater usefulness of dried raw, rather than digested, material for application on calcareous soils and as a supplemental foodstuff for ruminant animals is also a persuasive argument for increasing research activity on this product. In the Separation Technology and Source Development Program, two papers were prepared that summarized the last two year's work, a baseline method for preparing sodium zirconate was developed, and a literature search was conducted to find techniques for Pd, Ru, Rh separation.

ISOTOPIC POWER SUPPLIES

7535 (MLM—2562(OP)) **$^{238}PuO_2$ surface contamination of radioisotopic heat sources.** Schaeffer, D.R.; Brewer, C.Q. (Mound Lab., Miamisburg, OH (USA)). 1978. Contract EY-76-C-04-0053. 20p. (CONF-780907—4). Dep. NTIS, PC A02/MF A01.

From 4. conference on contamination; Washington, DC, USA (10 Sep 1978).

Surface contamination and cleaning characteristics of two radioisotopic heat sources are discussed. The Milliwatt Generator is a small (4 1/2 W) heat source which is successfully cleaned by hand in a series of hot acid baths.The Multi-Hundred Watt Isotopic Heat Source presents additional problems in removing the surface contamination because of its large size (100 W) and its grit-blasted surface. A study has characterized the behavior of the Pu during aging of the surface at the heat source service temperature of 1350°C. Results from this study show that normal decontamination

effectively removes the superficial Pu but does not extract the Pu which is deep within the grit-blasted structure. Subsequent heating results in migration of microcurie amounts of Pu out of the grit-blasted surface.

DESIGN AND FABRICATION

7536 (DPST—78-128-1/2) **^{238}Pu fuel form processes. Monthly report, January—February 1978.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1978. Contract EY-76-C-09-0001. 66p. Dep. NTIS, PC A04/MF A01.

This report is one of a series to summarize progress in the Savannah River ^{238}Pu Fuel Form Program. Goals of the Savannah River Laboratory (SRL) program are: to provide technical support for the transfer of DASMP and DMA ^{238}Pu fuel form fabrication operations from Mound Laboratory to new facilities at the Savannah River Plant (SRP), to provide the technical basis for ^{238}Pu scrap recovery at SRP, and to assist in sustaining plant operations.

7537 (LA—7460-PR) **General-purpose heat source project, space nuclear safety program. Progress report, and radioisotopic terrestrial safety program.** Baker, R.D. (comp.). (Los Alamos Scientific Lab., NM (USA)). Aug 1978. Contract W-7405-ENG-36. 36p. Dep. NTIS, PC A03/MF A01.

The studies related to the use of $^{238}PuO_2$ in radioisotopic power systems carried out for the Advanced Systems and Materials Production Division by the Los Alamos Scientific Laboratory are reported. The three programs involved are: (1) general-purpose heat source development; (2) space nuclear safety; and (3) radioisotopic terrestrial safety.

HYDROGEN

7538 (CONF-771131—) **Proceedings of the DOE chemical/hydrogen energy contractor review systems.** (Jet Propulsion Lab., Pasadena, CA (USA)). Aug 1978. Contract EC-77-A-31-1035. 297p. Dep. NTIS, PC A13/MF A01.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

The Chemical/Hydrogen Energy Systems Contractor Review was held at the Hunt Valley Inn, Hunt Valley, Maryland, on November 16-17, 1977. This Review meeting, scheduled annually by the DOE Division of Energy Storage Systems (STOR), was coordinated for DOE by the Jet Propulsion Laboratory in accordance with a task defined in the interagency agreement (EC-77-A-31-1035) between DOE and the NASA Office of Energy Programs. The meeting served as an effective means to (1) give all participants an insight into the background and objectives of thirty-nine hydrogen-related tasks, (2) show the status of the studies or technical effort, (3) relate any problems that had impeded the progress, and (4) state projected solutions for resolving the identified problems. Approximately 100 representatives from government and the private sector participated in the Contractor Review. Individual papers are indexed for inclusion in the energy data base.

7539 **Hydrogen.** Reed, R.M. pp 4.26-4.43 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The basic characteristics of hydrogen are discussed along with hydrogen as an energy source for motive power, hydrogan as a heating fuel, hydrogen as an energy transport, sources of hydrogen, and chemical uses of hydrogen. (JRD)

PRODUCTION

REFER ALSO TO CITATION(S) 7390, 7528, 7574, 7580

7540 (CONF-771131—, pp 5-13) **NASA's support of DOE's hydrogen energy storage program.** Kelley, J.H. (California Inst. of Tech., Pasadena). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

Early in 1977, ERDA and NASA established Interagency Agreement EC-77-A-31-1035 through which NASA is providing assistance to ERDA in their Hydrogen Energy Storage Program. The total supporting effort has been brought together as a NASA project. It is composed of a number of elements which will be conducted at several NASA centers. The project is being coordinated and managed at the Jet Propulsion Laboratory with the Ames Research Center and the Lewis Research Center participating in the conduct and management of several elements. In FY77, the project is largely concerned with monitoring ongoing ERDA contracts and planning for FY78 technical work. A number of specific technical tasks are planned for FY78.

7541 (SAND—78-0191C) **Fuels from magma: a potential energy source.** Gerlach, T.M. (Sandia Labs., Albuquerque, NM (USA)). [nd]. Contract EY-76-C-04-0789. 8p. (CONF-780737—1). Dep. NTIS, PC A02/MF A01.

From 2. circum-pacific energy and mineral resources conference; Honolulu, HI, USA (30 Jul 1978).

The chemical and thermodynamic basis, the confirmatory laboratory experiments, and the geological data that point to the potential of magma as a resource that could produce large amounts of hydrogen as well as carbon monoxide and methane are discussed. The method of fuel production proposed here depends principally on the reducing action of basalt on injected water; this chemical interaction causes the oxidation of ferrous components in the basalt and the production of hydrogen. The amount of hydrogen produced by a given body of basalt can be enhanced by introducing natural organic matter (biomass) into the injected water. This also would permit the method to be used to produce appreciable quantities of carbon monoxide and methane, and allows the exploitation of less FeO-rich magmas and hot rocks. Calculations show that the thermal energy of the magma may be used to gasify the biomass with resultant gas species resembling those from more conventional coal gasification processes.

7542 **Hydrogen: its technology and implications. Volume I. Hydrogen production technology.** Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977). 204p. $151.40.

Individual chapters are devoted to water electrolysis, thermochemical water decomposition, hydrogen from fossil fuels, hydrogen from nuclear energy, and hydrogen from solar energy. (LK)

ELECTROLYSIS

REFER ALSO TO CITATION(S) 7561, 7564, 7575, 9333

7543 (BNL—24906) **Fusion energy for hydrogen production.** Fillo, J.A.; Powell, J.R.; Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 7p. (CONF-780953—6). Dep. NTIS, PC A02/MF A01.

From 10. symposium on fusion technology; Padova, Italy (4 Sep 1978).

The decreasing availability of fossil fuels emphasizes the need to develop systems which will produce synthetic fuel to substitute for and supplement the natural supply. An important first step in the synthesis of liquid and gaseous fuels is the production of hydrogen. Thermonuclear fusion offers an inexhaustible source of energy for the production of hydrogen from water. Depending on design, electric generation efficiencies of approximately 40 to 60% and hydrogen production efficiencies by high temperature electrolysis of approximately 50 to 70% are projected for fusion reactors using high temperature blankets.

7544 (BNL—50852) **Electrolysis-based hydrogen storage systems. Semiannual report, 1 July—31 December 1977.** Salzano, F.J. (Brookhaven National Lab., Upton, NY (USA)). Jan 1978. Contract EY-76-C-02-0016. 47p. Dep. NTIS, PC A03/MF A01.

The work described in this report was accomplished during the period July 1—December 31, 1977, on a DOE-sponsored program aimed at improving the cost and efficiency of electrolytic hydrogen production and at developing the technology of metal-hydride hydrogen storage for stationary and transportation applications. The related work of organizations having subcontracts with BNL is included, and the effort on systems studies and project management for DOE are summarized. Work in the hydrogen production area includes hardware development and cell-materials testing for both acid and alkaline water electrolyzers. Also reported is related work on development and analysis of the reversible H_2—Cl_2 electrochemical cell, which is the key component in an electrical energy storage system proposed for utility use. Some results on a techno-economic assessment of this system are also given. In the area of hydrogen storage, progress is reported on solutions to the hydride expansion problem, design of the Hydrogen Technology Advanced Component Test System, construction of two hydrogen reservoirs, characterization and production of FeTi-based hydrides, improved hydrides, and the Hydrogen Homestead.

7545 (CONF-771131—, pp 17-26) **Development status of solid polymer electrolyte water electrolysis for large scale hydrogen generation.** Russell, J.H.; Nuttall, L.J. (General Electric Co., Wilmington, MA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

In a joint U.S. Department of Energy, Utility and Company sponsored program, General Electric is developing the solid polymer electrolyte (SPE) water electrolysis technology for large scale hydrogen generation applications. The goals for this program were established on the basis of a design study for a 58 MW plant that was conducted in 1975. Subsequent parallel technology development and hardware scale-up efforts have resulted in significant progress toward the accomplishment of these goals. Developments to date under this program include a cell design capable of operation at much higher temperatures (up to 150°C) and having a much lower manufacturing cost than the baseline design used in previous aerospace electrolysis applications. An improved oxygen evolution electrocatalyst has also been found which is both less expensive and more efficient than the baseline cell. As a first step in scaling up to large size cells, the design of a $2^1/_2$ ft^2 active area cell has been completed and fabrication is in progress. A 50 KW module, consisting of 12 cells of this design is expected to be on test by mid-1978. Photographs of the cell hardware are shown and preliminary test results presented.

7546 (CONF-771131—, pp 34-41) **Investigations on materials for advanced water electrolyzers.** Srinivasan, S.; Lu, P.W.T.; Kissel, G.; Kulesa, F.; Davidson, C.R.; Huang, H.; Gottesfeld, S.; Orehotsky, J. (Brookhaven National Lab., Upton, NY). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The development of advanced water electrolyzers is currently aimed at the further increased energy efficiency, reduced capital costs and prolonged life time. Efforts have been made to find stable materials for cell construction and to search for better electrocatalysts for the hydrogen and oxygen electrodes. Optical techniques were used to determine the correlations between optical properties of oxide films formed on Ir and Ru and their electrocatalytic activities for the oxygen evolution reaction (OER). Ellipsometric studies revealed that the variation of oxygen overpotential with time on Ni is essentially due to the gradual conversion of Ni^{3+} to Ni^{4+} in the oxide film on the electrode surface. The electrocatalytic activities of aged electrodes are rejuvenated using electrochemical methods. Oxide catalysts of spinel or perovskite structure such as $NiCo_2O_4$ and Ba_2MnReO_6 were investigated as oxygen electrodes. Effects of magnetic properties on the electrocatalysis for the OER were studied on lithiated nickel oxide and on Ni-Cu alloys. Nickel boride and $NiCo_2O_4$ show higher catalytic activities than Ni for hydrogen and oxygen evolution, respectively, particularly for long term operations. Materials for separators, gaskets, seals and cell frame have been evaluated in single cells, operating at temperatures up to 150°C. The preliminary results indicate that there is a loss of 2% in coulombic efficiency for the electrolytic hydrogen production at 120°C as compared with 25°C.

7547 (CONF-771131—, pp 42-46) **Advanced alkaline electrolysis cell development.** Murray, J.N.; Yaffe, M.R. (Teledyne Energy Systems, Timonium, MD). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The general approach and test results are presented from the Task One screening of thermoplastic polymers as potential electrode separators for use in alkaline solution electrolysis systems. The program has now proceeded into the (Task Two) design and fabrication of a high temperature, applied research test system. The general description of the test system is given and an outline for the upcoming program is discussed.

7548 (CONF-771131—, pp 47-49) **Selection and characterization of materials for advanced water electrolyzers: asbestos diaphragm failure and cathode kinetics.** Moran, P.J.; Cahen, G.L. Jr.; Stoner, G.E. (Univ. of Virginia, Charlottesville). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

Two problems which adversely affect performance of alkaline electrolyzers are matrix failure and time dependent increases in cell voltage. Observations of both of these phenomena have been documented and measured as functions of operating conditions. Several possible explanations are proposed for these two effects, and possible solutions are under investigation.

7549 (CONF-771131—, pp 50-53) **Optical investigation of the oxides of ruthenium and iridium in relation to their electrocatalytic activity.** Pollak, F.H. (Belfer Graduate School of Science, New York). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

It has been suggested that the problem of current decay with time in the oxygen evolution reaction in water electrolysis is connected with the continuous growth of a poorly conducting oxide film on catalyst surface. Optical techniques can yield valuable information concerning the dynamics of oxide formation as well as the nature of the oxide. The highly sensitive technique of the rotating light pipe reflectometer can be used to investigate the time and spectral dependence of reflectivity change on Ru and Ir catalyst surfaces in conjunction with electrochemical determinations. These materials have been shown to be superior to Pt. In addition this optical technique can be employed to evaluate the intrinsic reflectivity of RuO_2 and IrO_2 in the range 0.5 to 10 eV to gain information concerning the d-electrons of these materials.

7550 (CONF-771131—, pp 63-70) **Sulfur cycle water decomposition system.** Farbman, G.H. (Westinghouse Electric Corp., Pittsburgh). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The objective of this program is to assess the technical and economic feasibility of a hydrogen generation process, called the Sulfur Cycle Water Decomposition System, based upon the electrolysis of sulfurous acid. To do this, a multi-task program is being carried out to experimentally determine the operating characteristics of the key process steps in the hydrogen generating cycle and to develop the technology to the point where a bench scale integrated process development unit, operating at conditions similar to those expected in commercial plants, can be designed, built, and operated by Fiscal Year 1983. The experimental programs being conducted and discussed are concerned with the sulfurous acid electrolysis, materials for handling high temperature sulfuric acid and $SO_3/SO_2/O_2$/steam mixtures, and sulfur trioxide reduction. In addition, performance characteristics of the process are presented.

7551 (CONF-771131—, pp 115-121) **Hydrogen production by photoelectrolytic decomposition of water using solar energy.** Rauh, R.D.; Reise, T.F.; Alkaitis, S. (EIC Corp., Newton, MA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The conversion of light to chemical energy can be effected through the photoelectrolysis of water to produce H_2 and O_2. The aim of this program is to discover semiconducting photoelectrode materials which have optimal band gaps, electron affinities and stabilities for this application.

7552 (CONF-771131—, pp 253-255) **Hydrogen from falling water: assessment of the resource and conceptual design phase.** Escher, W.J.D. (Inst. of Gas Tech., Chicago); Palumbo, J.P. Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

A unique opportunity to develop a supplemental solar-hydrogen gas energy system presents itself in the many small, presently unused hydropower facilities in the United States. As opposed to generating conventional electricity, turbine-generators would be directly coupled to water electrolyzers for the production of hydrogen and oxygen. There appear to be significant advantages to this approach from the standpoint of delivering energy via a distribution system to the end user. At present, an assessment of the falling water resource in terms of hydrogen energy potential is being conducted for the U.S. Northeastern states. Conceptual design efforts on the energy conversion station are also being carried out. If these initial results are favorable, the construction of an operating falling water to hydrogen energy conversion facility would be in order. Such a station might serve as a flexible R and D facility for further development of this approach at achieving new energy supplies from inexhaustible resources.

7553 **Water electrolysis.** Fickett, A.P.; Kalhammer, F.R. pp 3-41 of Hydrogen: its technology and implications. Volume I. Hydrogen production technology. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

Topics discussed are: fundamentals of water electrolysis; generic types of water electrolysis systems; electrolysis system requirements; water electrolysis technologies; economics of water electrolysis; and projection and impact of technological advances. (LK)

THERMOCHEMICAL PROCESSES

REFER ALSO TO CITATION(S) 7550, 7560, 7561

7554 (CONF-771131—, pp 71-78) **Current status of the thermochemical water-splitting program at General Atomic.** de Graaf, J.D.; Russell, J.L.; Norman, J.H.; Ohno, T.; Trester, P.W.; McCorkle, K.M. (General Atomic Co., San Diego, CA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

General Atomic's thermochemical water-splitting program is in its sixth year of development. It is presently a cooperative effort with support from the U.S. Department of Energy and the American Gas Association. Since the selection of the cycle in 1974, research on a broad basis has been carried out and considerable progress in the area of chemistry, process engineering, as well as material investigations, has been made. Under DOE contract EY-76-C-03-0167, Project Agreement 63, GA is conducting bench-scale technology validation studies and process engineering. The bench-scale investigations are aimed at engineering approaches for conducting the chemical reactions and separation processes as continuous operations. For these investigations the process is broken up into three subunits: (1) the main solution reaction unit, (2) the sulfuric acid unit, and (3) the hydrogen iodide unit. The first unit has been built and is ready for testing. The second unit has been designed, while the third unit is still in the conceptual stage. The development of a third generation process flowsheet is in progress. Recent improvements found in the chemistry will be incorporated, and also major friction pressure losses will be taken into account. In this work the process simulator code DESIGN/2000 from the Chemshare Corporation will be applied.

7555 (CONF-771131—, pp 79-82) **Assessment of thermochemical hydrogen production.** Dafler, J.R.; Foh, S.E.; Schreiber, J.D. (Inst. of Gas Tech., Chicago). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

A base-case, or first-cut, flowsheet for IGT Cycle B-1 has been completed. Calculation of the energy balance has allowed us to define the worst problem areas in the overall process, and optimization effort has been directed to these parts of the process. Operation of the $FeCl_2$-hydrolysis at pressures sufficient to interface with projected hydrogen transmission lines will apparently necessitate higher hydrolysis temperatures. Higher pressure, however, favors some of the critical separation steps. The work of Schuetz and others on electrolysis and on the thermodynamics of the HBr-H_2O system is being reviewed. Work plans for this part of the contract effort are summarized.

7556 (CONF-771131—, pp 83-86) **Thermochemical hydrogen production review panel.** Funk, J.E. (Univ. of Kentucky, Lexington). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The hydrogen production review panel was established to review and evaluate engineering flowsheets for various thermochemical cycle. Areas of concern are chemistry, materials, cost, and flowsheet and efficiency (heat penalty analysis).

7557 (CONF-771131—, pp 87-92) **LASL thermochemical hydrogen program status on October 31, 1977.** Cox, K.E.; Bowman, M.G. (Los Alamos Scientific Lab., NM). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The LASL Hydrogen Program is continuing its investigation of practical schemes to decompose water thermochemically for hydrogen production. Efforts were and are being devoted to process improvements in cycles that use sulfuric acid as an intermediate. Sulfuric acid-hydrogen bromide cycles are being studied as a means of overcoming the heat penalty in drying acid solutions. An alternate approach involves the use of insoluble bismuth sulfate that is precipitated from acid solution. Preliminary energy balances indicate a significant increase in cycle efficiency for both these options.

7558 **Thermochemical water decomposition.** Funk, J.E. pp 45-57 of Hydrogen: its technology and implications. Volume I. Hydrogen production technology. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

The following topics are discussed: thermodynamics of the overall process; definition of process thermal efficiency; the single-stage process; the two-stage process; multistage processes; work of separation; and process evaluation. (LK)

7559 **Thermochemical production Process of H_2.** Norman, J.H.; Russell, J.L. Jr.; Porter, J.T. II; McCorkl, K.M.; Roemer, T.S.; Sharp, R. (to General Atomic Co., San Diego, Calif. (USA)). French Patent 2,320,258/A/. 2 Aug 1976. Priority date 4 Aug 1975, United States of America (USA). 11p. (In French).

This invention concerns the thermochemical production of H_2. In the special thermochemical cycle described, it is possible to obtain a yield between 30 and 60% and the thermal requirement of this cycle corresponds to the operating conditions of the HTGR-type reactors. A production process of H_2 from water is described. Hydrogen iodide and sulfuric acid are prepared by a chemical reaction between iodine, sulfur dioxide and water. Two aqueous phases are formed, the lighter containing the major part of H_2SO_4 produced, and the heavier containing the major part of hydrogen iodide produced. The two phases are separated and hydrogen iodide is heated up to the decomposition temperature into I_2 and H_2.

STEAM REFORMER PROCESSES

REFER ALSO TO CITATION(S) 7579

7560 **Hydrogen from nuclear energy.** Jiacoletti, R.J. pp 119-141 of Hydrogen: its technology and implications. Volume I. Hydrogen production technology. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

The chapter on hydrogen from nuclear energy covers development requirements and three methods of hydrogen production with nuclear process heat (steam reforming, hydrogen from coal, and thermochemical decomposition of water). (LK)

BIOSYNTHESIS AND PHOTOCHEMICAL PROCESSES

7561 **Hydrogen from solar energy.** Cox, K.E. pp 145-175 of Hydrogen: its technology and implications. Volume I. Hydrogen production technology. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

Topics discussed include ocean thermal energy conversion, power from wind, biomass, artificial solar collection schemes, methods of solar energy conversion to hydrogen (water electrolysis, photoelectrolysis, biophotolysis, and thermochemical decomposition of water), and economics of hydrogen production from solar energy. (LK)

COAL GASIFICATION

REFER ALSO TO CITATION(S) 7560

STORAGE

REFER ALSO TO CITATION(S) 7540, 7580

7562 (CONF-771131—, pp 146-157) **Hydrogen compatibility of structural materials for energy storage and transmission applications.** Robinson, S.L. (Sandia Labs., Livermore, CA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The suitability of structural materials for service in hydrogen energy storage and transmission applications is being investigated in several ways. The goal is to provide performance data for cost effective safe structures, and to improve the hydrogen environment performance of structural steels. Material performance in hydride containment vessels has been characterized by in-situ tests of tensile specimens, vessel bulging phenomena have been analyzed, and fatigue cracking hazards assessed. The use of existing natural gas pipeline systems for hydrogen transmission is being explored

through an experimental hydrogen pipeline, which will be used to assess the sensitivity of pipeline materials to defects and flaws. The performance of carbon-manganese mild steels has been improved by alteration of the metallurgical processing methods and by minor alloying additions. In addition, the effects of microstructural modifications upon hydrogen compatibility of pipeline steels are being assessed.

7563 Hydrogen: its technology and implications. Volume II. Transmission and storage. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977). 153p. $151.40.

Individual chapters are devoted to transmission of gaseous hydrogen, metal hydrides as hydrogen storage media and their applications, liquid hydrogen storage and transmission, and materials for hydrogen service. (LK)

CHEMISORPTION

REFER ALSO TO CITATION(S) 7544, 7576, 8334

7564 (CONF-771131—, pp 3-4) **Electrolysis-based hydrogen storage systems overview and rationale of the Brookhaven National Laboratory managed program.** Salzano, F.J. (Brookhaven National Lab., Upton, NY). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The rationale for determining program direction, emphasis, and allocation of resources is presented.

7565 (CONF-771131—, pp 191-195) **DRI research program on improved hydrides.** Lundin, C.E.; Lynch, F.E.; Magee, C.B. (Univ. of Denver). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The emphasis in this research program is to develop new and improved hydride storage materials. The approach will be to employ DRI developed predictive techniques to select candidate systems. Those systems with potential will be fully characterized and ultimately optimized by alloy addition. The goal is to develop hydrides with more than 3 weight percent hydrogen. The studies during this review period were devoted principally to five subject areas. These were: (1) studies of AB_2 Laves phases and their hydriding characteristics, (2) the analysis of hysteresis effects in hydride storage materials and the development of a rationale for hysteresis effects, (3) hydriding studies of ANi_5 systems in which Ni was partially replaced with two neighboring elements, (4) hydriding studies of titanium-base, beta solid solution alloys, and (5) design, procurement, and construction of a new Sievert's apparatus and an activation apparatus.

7566 (CONF-771131—, pp 196-205) **Thermodynamic and economic study of various techniques for the large scale production of hydriding grade FeTi.** Trozzi, C.J.; Sandrock, G.D. (International Nickel Co., Inc., Suffern, NY). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The intermetallic compound FeTi has considerable potential as a hydrogen storage medium. This paper represents a survey of possible large scale production methods for FeTi and related compounds. Direct and indirect reduction of ilmenite ore is considered in thermodynamic and economic detail. Results show that thermodynamics, economics and impurity effects make the direct production of FeTi from ilmenite unlikely. For the foreseeable future FeTi will be made by the melting of primary sponge Ti and scrap steel at final selling prices slightly above $2.00/pound.

7567 (CONF-771131—, pp 206-209) **Stationary hydride vessel of large diameter: program plan.** Billings, R.E.; Woolley, R.L.; Ruckman, J.H. (Billings Energy Corp., Provo, UT). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

A metal hydride vessel of engineering scale has recently been installed as a peak shaving component of the BEC "Hydrogen Homestead." Operational performance and vessel behavior are to be computer monitored for a one-year period. Of particular interest are heat transfer characteristics and the consequence of hydride packing in a large hydride vessel with a hemispherical end cap. This paper discusses planned experiments and operation of the vessel. Instrumentation debugging is now proceeding preparatory to the start of data collection.

7568 Metal hydrides as hydrogen storage media and their applications. Reilly, J.J. pp 13-48 of Hydrogen: its technology and implications. Volume II. Transmission and storage. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

A discussion of metal hydride chemistry lays the foundation for a discussion of specific metal hydride systems (magnesium and magnesium alloys, rare earth alloys, iron-titanium alloys, and vanadium dihydride). Applications of metal hydrides considered are peak shaving, automotive, thermal storage, and pumps and compressors. (LK)

CRYOGENIC

7569 Liquid hydrogen storage and transmission. Edeskuty, F.J.; Williamson, K.D. Jr. pp 51-81 of Hydrogen: its technology and implications. Volume II. Transmission and storage. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

Design and operational considerations of storage systems and transfer systems are discussed. (LK)

TRANSPORT

REFER ALSO TO CITATION(S) 7562, 7563, 7569, 7583, 8684

7570 (CONF-771131—, pp 129-134) **NASA experience with gaseous hydrogen.** Hagler, R. Jr. (California Inst. of Tech., Pasadena). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

A survey of NASA agencies and private companies who have had experience with gaseous hydrogen facilities was conducted by JPL during FY'77. This report identifies facility capability and attempts to assess the current status of the equipment. The majority of the hydrogen experience was found to cluster within the agencies and companies who have been active in the LH_2/LOX Rocket Engine Programs (Apollo, Centaur, and Space Shuttle).

7571 (CONF-771131—, pp 135-140) **Study of the behavior of gas distribution equipment in hydrogen service: update, 1977.** Pangborn, J.B.; Johnson, D.G.; Jasionowski, W.J. (Inst. of Gas Tech., Chicago). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The Institute of Gas Technology is conducting an experimental program to identify problem areas that could occur with the use of conventional natural gas distribution equipment in hydrogen service. Funded by DOE, there are 15 manufacturers and gas distribution companies which are participating by loaning or donating equipment and services. Three model test loops have been constructed and are operational: a Residential/Commercial loop with smaller sized components, an Industrial loop with larger sized components, and a small test loop for special (created) leakage tests. We are measuring flow rates and energy delivery, and leakage rates, and we will note apparent problems in materials compatibility. Baseline data on natural gas operation are just becoming available.

7572 Transmission of gaseous hydrogen. Leeth, G.G. pp 3-10 of Hydrogen: its technology and implications. Volume II. Transmission and storage. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

Gas pipelines, gas pipeline dynamics, gas pipeline costs, hydrogen pipeline analyses, hydrogen pipeline safety, and hydrogen pipeline operating experience. The author concludes that transmission of hydrogen gas in a large pipeline network is technically and economically feasible. For large energy flow rates, the transmission cost would be approximately 50% greater per energy unit than for natural gas. Sufficient experience is available to be confident that hydrogen pipelines can be designed, built, and safely operated on a commercially profitable basis. Modification of existing natural gas pipelines to transport hydrogen is probably feasible. (LK)

MARKETING AND ECONOMICS

REFER ALSO TO CITATION(S) 7574

INDUSTRIAL AND COMMERCIAL USE

7573 (CONF-771131—, pp 213-217) **Hydrogen as a chemical feedstock (study and workshop).** Huang, C.J. (Univ. of Houston, TX); Tang, K.K. Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The objective of this study and workshop is to determine steps which can, and should, be taken to enable and encourage a shift in the chemical industries from natural gas and naphtha as hydrogen sources to other energy forms. Preliminary findings of informal interviews conducted prior to the workshop are summarized for key segments of the hydrogen market. Plans for the workshop to be held in December 1977 are discussed.

7574 (CONF-771131—, pp 218-233) **Use of hydrogen energy systems to implement solar energy.** Fujita, T.; Miller, C.; Chen, K.H.; Voecks, G.; Mueller, W. (Jet Propulsion Lab., Pasadena, CA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

As the first phase of a study to explore the use of hydrogen energy systems to implement solar energy, potential roles are broadly identified in terms of future markets and the formulation of implementation scenarios. By converting solar energy to hydrogen, an energy pathway is created whereby solar energy can supply major new markets comprising (1) production of chemicals such as ammonia and methanol, (2) total energy/cogeneration, (3) synfuel/chemical feedstock production, (4) direct fuel uses, and (5) other small but important uses such as ore reduction. These new market opportunities for implementing solar energy are predicated primarily on the unique role of hydrogen as a key element in the chemical/industry sector. Implementation of solar-hydrogen systems to fulfill these new markets is analyzed in terms of key issues. By considering the renewable fuel era (estimated to start in approximately 2030), where fossil sources are sharply declining, a critical and major role for hydrogen systems is identified. In the absence of fossil fuels, the survival of our entire hydrocarbon-based chemical industry requires use of solar (or other non-fossil sources) to generate hydrogen from water. The key issues then revolve about developing and implementing solar-hydrogen systems to effect a smooth transition directed toward fulfilling this ultimate role. Issues governing implementation include conservation policies, possible environmental impacts from carbon dioxide generated from continuing accelerated usage of fossil fuels, and emergence of large markets for byproduct oxygen. These issues are addressed in terms of their potential for accelerating implementation of solar-hydrogen systems.

7575 (CONF-771131—, pp 246-252) **System evaluation of supplementing natural gas supply with hydrogen.** Ku, W.S. (Public Service Electric and Gas Co., Newark, NJ). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The production of hydrogen by electrolysis using excess energy available from base-load electric generating units provides one potential means of supplemental future dwindling natural gas supply. Advanced electrolyzer technology now in the research stage was applied for the evaluation. A maximum of 15% volume blending of hydrogen was assumed. No hydrogen storage was applied. The results indicate that electrolytic hydrogen could become economically competitive in the 1990 to 2000 period with high-cost supplemental natural gas supply.

7576 (CONF-771131—, pp 256-264) **Hydrogen engine/storage system: application studies.** Karaba, A.M.; Pearsall, T.J. (Teledyne Continental Motors, Muskegon, MI). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The study addressed the unique problems associated with the storage and use of hydrogen. Criteria were established for evaluating potential applications, and a near-term candidate was selected and performance predictions were made. A hydride bed design was proposed, and engine modifications were outlined. The costs to own and operate a hydrogen fueled engine were analyzed, and it was concluded that early applications will require incentives other than economic. Several practical problems need to be addressed now. An expansion of the present effort, including development of both components and integrated systems, was recommended.

7577 (CONF-771131—, pp 267-272) **Natural gas supplementation with hydrogen.** Guerra, C.R.; Griffith, J.E.; Kelton, K.; Nielsen, D.C. (Public Service Electric and Gas Co., Newark, NJ). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The potential supplementation of natural gas with hydrogen is being evaluated. The studies include: (1) combustion tests of gas blends in burners and appliances, (2) computation of capacity of a distribution network and system adjustments to deliver gas blends and (3) measurement of gas leakage from prototype joints of mains removed from a gas distribution grid. The results show that main burners can burn blends with up to 20 to 25% hydrogen in natural gas, but target pilots limit the hydrogen concentration to 6 to 11%. After modification of pilot orifice or increase in gas supply pressure, blends with up to 20% hydrogen were found satisfactory for use in most burners and appliances. The flow studies indicate that natural gas with up to 20% hydrogen could be readily adapted to utility operations at the gas pressure and flows used in the distribution, utilization and service subsystems of the grid. The metering station appears to be the most suitable site for introducing hydrogen into the distribution system. Measurements of gas leakage from joints containing blends of hydrogen with natural gas are currently underway.

7578 (CONF-771131—, pp 273-287) **Hydrogen as a mid-term gaseous fuel supplement by blending with natural gas.** Steinmetz, G.F. (Baltimore Gas and Electric Co.). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The Ad Hoc Committee studied the potential for mid-term (1985 to 2000) commercial application of the use of hydrogen for blending into the present natural gas delivery system as an energy supplement. Successful development of advanced electrolyzer technology and the availability of low cost "off-peak" electric generating capacity are basic to this concept. The Committee determined that a major, federally funded research, development, and demonstration program aimed at proving the technical feasibility is not justified within the next five years. Basic reasons are that even a completely successful RD and D program would not spur mid-term commercialization to: Produce sufficient hydrogen to significantly alleviate the natural gas shortage on a national basis, produce hydrogen at a cost competitive with other supplemental gaseous fuels if present price projections hold true, and provide the electric power industry with incentives to devote available generating capacity to this end in competition with various storage concepts, operating alternatives, and end uses under development. The Committee found no overriding environmental, safety, legal, code, or regulatory considerations which would preclude the hydrogen-natural gas supplementation concept.

7579 (CONF-771175—, pp 6.3.1-6.3.7) **Fuel converter with methanol for spark-ignition internal combustion engine.** Sjostrom, K. (Royal Inst. of Tech., Stockholm). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

A "hydrogen injection" system is presented. Hydrogen is produced in a catalytic steam reforming reactor using methanol or gasoline as fuel. Energy is supplied by heat exchange with the exhaust gas. Catalytic studies with nickel catalyst are presented for the special reactant gas composition in the reactor. Theoretical evaluation of the system shows that methanol is an excellent fuel for the reactor. The system permits very lean air/fuel mixtures with a gain in the fuel consumption and an excellent emission picture. The experimental results show that it is possible to drive the engine with air/fuel rates of 1.4 with emissions of 10 ppm NO.

PROPERTIES

REFER ALSO TO CITATION(S) 7562, 7563, 7571, 8684

7580 (CONF-771131—, pp 109-114) **Applications of solubility parameters. Part I.** Lawson, D.D. (California Inst. of Tech., Pasadena). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The long range objective of this work is to create a simple means of quantitatively dealing with the physicochemical nature of the interaction of hydrogen (atomic or gaseous forms) and other fluids with materials used in hydrogen production and/or storage environments. In the following sections, definitions and related data will be presented as a starting point to achieve the above objective.

7581 (CONF-771131—, pp 141-145) **Hydrogen—metal interactions.** Nelson, H.G. (Ames Research Center, Moffett Field, CA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The NASA-Ames Research Center program consists of three tasks: (1) identify the influence of hydrogen/methane blend on the fracture behavior of carbon steel; (2) establish the kinetic of hydrogen entry into carbon steel from the dissociation of FeTiH/sub x/; and (3) establish the kinetics of hydrogen entry from a methane environment. In hydrogen/methane blends, fatigue crack growth rate of the ferritic steel was found to increase as a function of the partial pressure of hydrogen with the presence of methane having no apparent influence. At a hydrogen partial pressure of MPa crack growth rate is as much as 20 times more rapid than that observed in air and 100 times more rapid than observed in vacuum.

7582 (CONF-771131—, pp 158-163) **Effect of stress state on hydrogen embrittlement processes.** Louthan, M.R. Jr.; McNitt, R.P. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

Delayed failure hydrogen embrittlement studies in high pressure gaseous hydrogen show that the susceptibility to embrittlement progressively increases as the stress state changes from uniaxial to biaxial to triaxial. This contrasts the results to dynamic tests in similar atmospheres where embrittlement is favored by uniaxial stress states. These results show that design considerations of material compatibility in hydrogen environments must include analysis of the stress-state and loading-rate during exposure. Such considerations are difficult, at present, because of (1) difficulties in extrapolating data from short-time dynamic tests to predict long time compatibility under static loads, and (2) very little definitive work on the role of macroscopic stress state in hydrogen embrittlement processes has been reported.

7583 (CONF-771131—, pp 164-167) **Evaluation of laser welding techniques for hydrogen transmission.** Harris, J.A. Jr.; Mucci, J. (Pratt and Whitney Aircraft Group, West Palm Beach, FL). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

This program will evaluate the smooth and notched tensile, low-cycle-fatigue and fracture toughness properties of two pipeline materials, ASTM A312 Grade AISI 304L and ASTM A106 Grade B, in parent and welded (Laser, Electron Beam and GTA) conditions. Testing in air and 13.8 MPa (2000 psig) gaseous hydrogen will establish the susceptibility of the materials to hydrogen environment effects. Metallurgical analysis of the weldments and fractographic evaluations of failed test specimens will be conducted to supplement the mechanical property characterizations and aid in determining if laser welding is feasible for hydrogen transmission pipeline application. The program started on 30 September 1977. This paper discusses the program objectives, approach and status to date.

7584 **Kinetic laws of H_2O_2 accumulation at the upper limit of spontaneous ignition of hydrogen.** Poroykova, A.I. *Teploenergetika (Moscow);* No. 1, 529-533(1978).

A study was made concerning the kinetics of H_2O and H_2O_2 accumulation in quartz vessels treated with acids (HF, HNO_3, H_3BO_3), during the period of induced sputtering and within the range of slow reaction near the third limit of spontaneous ignition of hydrogen. Water is found to form according to the law of autocatalysis, while H_2O_2 accumulates almost linearly during the earlier stage of the reaction. The $[H_2O_2]/[H_2O]$ ratio depends on the vessel treatment even during the earlier stage of the reaction, but it increases with rising temperature and hydrogen concentration in the mixture. Hydrogen peroxide is the main primary product of the reaction under actual test conditions. According to the available experimental data, autocatalysis by water vapor must be explained by other processes in addition to the Boltzmann mechanism, and spontaneous heating of the mixture must also be taken into account.

7585 **Materials for hydrogen service.** Thompson, A.W. pp 85-124 of Hydrogen: its technology and implications. Volume II. Transmission and storage. Cox, K.E.; Williamson, K.D. Jr. (eds.). Cleveland; CRC Press, Inc. (1977).

The following topics are discussed: manifestations of hydrogen damage, materials characteristics for hydrogen service, behavior of alloy systems in hydrogen, structural behavior of engineering systems, hydrogen energy system applications, and materials feasibility of a hydrogen energy system. (LK)

7586 **Hydrogen: its technology and implications. Volume III. Hydrogen properties.** McCarty, R.D. Cleveland; CRC Press, Inc. (1975). 332p. $151.40.

Properties discussed include compressibility coefficient, accommodation coefficient, compressibility factor, isothermal compressibility, dielectric constant, diffusion coefficient, thermal diffusivity, dielectric breakdown, enthalpy, entropy, equation of state, virial coefficients, intermolecular potential function, fixed points, heat capacity at constant pressure, heat capacity at constant volume, heat capacity of the saturated liquid at constant saturation, heat capacity ratio, ideal gas properties, index of refraction, internal energy, Joule-Thomson coefficient, latent heat of fusion, latent heat of sublimation, latent heat of vaporization, melting curve, melting pressure, phase diagram, Prandtl number, PVT, radiative properties, saturation properties, sound velocity, sound absorption, surface tension, thermal conductivity, thermodynamic diagrams, vapor pressure, viscosity, adiabatic compressibility, mixture properties, free energy, heats of transition, and volume expansivity. Data are presented in 38 graphs and 13 tables. (LK)

OTHER SYNTHETIC AND NATURAL FUELS

HYDROCARBON FUELS

REFER ALSO TO CITATION(S) 8423

PROPERTIES

REFER ALSO TO CITATION(S) 7193, 7388, 7389, 7418, 8667

7587 **Heat transfer with boiling ethane and ethylene.** Kravchenko, V.A.; Tolubinskaya, L.F. (Ukr Acad of Sci, Eng Thermophys Inst, Ukr SSR). *Heat Transfer - Sov. Res.;* **9**: No. 3, 9-14(May-Jun 1977).

The results of an experimental study of pool boiling heat transfer with ethane and ethylene on a vertical stainless-steel tube over the pressure range from 1.26 to 29 bar are presented. Recommendations for the design of evaporators in natural-gas liquefiers and rectification equipment are given. 14 refs.

7588 **Thermophysical properties of ethane, from 90 to 600 K at pressures to 700 Bar.** Goodwin, R.D.; Roder, H.M.; Straty, G.C. Washington, DC; National Bureau of Standards (1976). 320p. GPO $3.85.

Using new specific-heat and PVT data, the National Bureau of Standards provides the first reliable set of thermodynamic functions for compressed liquid ethane at temperatures below its normal boiling point. The report presents the thermophysical properties of ethane at integral temperatures over the entire range of fluid states from 90 to 600°K along isobars to 700 bars. Thermodynamic functions in the compressed liquid at T < T/sub c/ are obtained by use of specific heats C/sub v/(T) along a high-density isochore and C(sub sigma/(T) for the saturated liquid. Researchers used a simplified and more constrained version of the equation of state than formerly used for methane because the PVT data, taken from

various sources, were not as consistent and precise as those for methane.

PREPARATION

CHEMICAL SYNTHESIS

REFER ALSO TO CITATION(S) 8584

7589 Method for the production of aeromatic hydrocarbons and olefin. Nametkin, N.S.; Fjodorow, W.W.; Feigin, J.A.; Kalinenko, R.A.; Tschernyj, I.R.; Botscharow, J.N.; Titow, W.B. (to AN SSSR, Moscow. Inst. Neftekhimicheskogo Sinteza; Vsesoyuznyj Nauchno-Issledovatel'skij i Proektnyj Inst. Neftepererabatyvayuscej i Neftechimiceskoj Promyslennosti, Moscow (USSR)). German(FRG) Patent 2,440,143/B/. 2 Jun 1977. 6p. (In German).

For the winning of aromatic hydrocarbons and olefins, the liquid products obtained in the processing of petroleum fractions or in bituminous coal coking or low-temperature carbonization are heat-treated in the presence of acyclic C_2- to C_4- hydrocarbons at temperatures between 750 and 950°C and at pressures between 1 and 10 atm. During the heat treatment, the nonaromatic hydrocarbons are decomposed while gaseous products are formed; in addition, there are hydrodealkylation reactions of hydrocarbons and reactions where styrene and indene etc. are formed. Thus, instead of a mixture of aromatic and nonaromatic hydrocarbons with neighbouring boiling temperatures, one obtains a mixture of aromatic hydrocarbons with widely different boiling temperatures which are easy to separate. The weight ratio of these noncyclic hydrocarbons to the liquid initial material should be no less than 0.3. Coking can be prevented by the presence of inert diluting agents. The heat carrier will be water in a tube reactor, or sand or coke in a fluidized-bed reactor or a reactor with heat carrier outflow.

7590 Catalytic rich gas (CRG) process for gasification of light hydrocarbons. Taylor, C.H. (Woodall-Duckham Ltd., Sussex, Eng.). pp 2.137-2.148 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The catalytic rich gas (CRG) process was developed for the production of a gas of relatively high calorific value from light hydrocarbons. The reactions are those employed in conventional steam reforming of natural gas (e.g., for production of hydrogen), but they take place at a lower temperature and steam-feedstock ratio. Under these conditions, the overall reaction is slightly exothermic, and can, therefore, be made sulf-sustaining in an adiabatic reactor. Development of the process is reviewed and information is given on process chemistry and thermodynamics removal of sulfur, gas production, LNG derichment, and SNG production. (JRD)

7591 Methane-rich gas process for substitute natural gas. Nojima, S. (Japan gasoline Co., Ltd., Tokyo). pp 2.149-2.159 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The methane-rich gas (MRG) process produces methane gas from feedstock hydrocarbons, such as naphtha, liquefied petroleum gases (LPG), and refinery gas. The basic reactions of the MRG process consist of three stages: (1) hydrodesulfurization of sulfur compounds in the hydrocarbon feedstock, (2) low-temperature steam reforming (gasification) of desulfurized hydrocarbons, and (3) methanation reaction between hydrogen and carbon dioxide in methane gas available by gasification. These reactions are described along with the MRG process flow. (JRD)

7592 Fluidized-bed hydrogenation process for substitute natural gas production. McMahon, J.F. (Foster Wheeler Energy Corp., Livingston, NJ). pp 2.160-2.163 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The fluidized bed hydrogenation (FBH) process involves the noncatalytic reaction of hydrocarbons and hydrogen to produce a methane- and ethane-rich gas which is further processed to substitute natural gas (SNG). The FBH process is particularly suited for the gasification of whole crude oil or crude oil fractions boiling above naphtha.

7593 Hydrocracking-hydrogasification process for producing pipeline gas from crude oil. Janka, J.C.; Seay, J.G.; Tarman, P.B. (Inst. of Gas Tech., Chicago). pp 2.164-2.170 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

In a continuous, two-step process developed by the Institute of Gas Technology (IGT), crude oil can be hydrocracked to approximately diesel oil weight and then made to react noncatalytically with hydrogen at elevated pressures (500 to 1500 psig) and temperatures (1100 to 1400°F) to produce methane-rich gas containing about 30 vol percent hydrogen and 10 vol percent ethane. This gas can be desulfurized and methanated to yield pipeline gas. By adjusting the conditions of hydrocracking, enough heavy fuel oil can be produced to provide feedstock for hydrogen production by partial oxidation, or a low-sulfur fuel oil product can be made if desired. Interest has centered on plants to produce substitute natural gas (SNG) from light distillate feedstocks, such as naphtha. However, when naphtha is in short supply, a process capable of converting the more plentiful crude and residual oils to pipeline gas is needed. A number of processes were developed over 20 years ago to provide supplemental gas in winter periods when demand is high. Because the supplemental gas was required for only 20 or 30 days during the year, only cyclic thermal cracking at atmospheric pressure was used, in order to avoid the high capital cost of more complex continuous processes. However, with the need for base-load gas, a continuous process would be feasible.

7594 Noncatalytic, partial-oxidation gasification process. Kuhre, C.J.; Sykes, J.A. Jr. (Shell Oil Co., Houston, TX). pp 2.171-2.174 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The shell gasification process (SGP) is designed for the partial combustion or oxidation of hydrocarbons and is particularly suitable for the partial combustion of heavy, sulfur-containing residual fuels and heavy crude oils to produce a mixture of hydrogen, carbon monoxide, and small amounts of other gases. The process is conducted by injecting oil and air (or oxygen) through a specially designed burner assembly into a closed combustion vessel, where partial oxidation occurs at about 2400°F. The term partial oxidation describes the net effect of a number of component reactions that occur in a flame supplied with less than stoichiometric oxygen.

PREPARATION FROM WASTES OR BIOMASS

REFER ALSO TO CITATION(S) 7328, 7541, 7640, 7641, 7643, 7644, 7647, 7648, 7683, 7684, 8436, 8437

7595 (COO—4225-1, pp 151-162) **Fuel gas production from biomass: progress and plans.** Wise, D.L. (Dynatech R/D Co., Cambridge, MA). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The potential for fuels from biomass is reviewed, specifically considering the over-all objectives of this activity of ERDA. It is seen that essentially all organic material obtained from biological sources may be in turn subjected to bioconversion processing technology in order to produce fuel gas or an array of organic chemicals. Clearly, the organic fraction of biomass may also be subjected to selected thermochemical conversion techniques. Following a broad overview, the specific example of fuel gas from animal residue is considered in some detail for purposes of evaluation. An example process of possible immediate use is the production of fuel gas from cattle feedlot residue. Here it is shown that 300 MCF (at STP) CH_4/day may be produced from an environmental feedlot of 10,000 head of cattle. Digester size, capital costs, and fuel gas price appear well within the requirements for early development of the required technology. In every respect, the entire fuels from biomass program appears to be a ready area for active development.

7596 (COO—4225-1, pp 173-208) **Thermochemical processing of biomass materials.** Garrett, D.E. (Garrett Energy Research and Engineering, Claremont, CA). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The thermochemical methods for the conversion of biomass into fuels are pyrolysis, partial oxidation, liquefaction, and catalytic gasification. The principal research programs sponsored by DOE in each of these areas are briefly described. The experimental data available for each process and an economic analysis are summarized. (JSR)

7597 (COO—4478-1) **Microbial production of aliphatic hydrocarbons. Progress report, August 1, 1977—July 31, 1978.** Tornabene, T.G. (Colorado State Univ., Fort Collins (USA). Dept. of Microbiology). Jul 1978. Contract EE-77-S-02-4478. 15p. Dep. NTIS, PC A02/MF A01.

In the process of screening microorganisms for those that synthesize acyclic oily hydrocarbons, 82 bacterial, fungal and algal isolates were cultivated, extracted and analyzed. Acyclic hydrocarbon biosynthesis was detected in 15% of the cells studied, establishing the fact that only specific microbial species synthesize hydrocarbons. Four of nine bacterial isolates from oil shale produced hydrocarbons in the range from C_{16} to C_{32} that accounted for 0.3 to 1.1% of cell dry weight. Additional studies established that these isolates grew on oil-shale as the sole support medium. Nine methanogens and two thermoacid-ophiles synthesized isoprenoid hydrocarbon in the range of C_{15} to C_{40} that accounted for 20 to 25% of the 3 to 5% total

lipids on cell dry weight basis. These isoprenoids consisted of families of hydrogenated intermediates from the unsaturated, such as squalene(S), to the saturated components, as squalene (S + 12 H). These components, in comparison to the studies conducted on the effects of aeration on the hydrocarbon content of an extreme Halophile, provided evidence to propose that these isoprenoids act as hydrogen donors and acceptors and function as proton regulators in the cells. Such a mechanism, with these types of intermediates, has not been previously realized. This information opens a new perspective in hydrocarbon production and petrogenesis. Other organisms studied provided hydrocarbons in the range from C_{12} to C_{36} that accounted for 0.1 to 0.25% of their cell dry weight. Hydrocarbon biosynthesis studies have demonstrated that metals are effective inhibitors, and that a potent inhibitor of hydrocarbon synthesis exists in lysates of cells. The investigation of the regulatory mechanism that controls hydrocarbon biosynthesis in bacterial cells, which is in progress, is a vital step in developing a microbial oil producer.

7598 Energy gained from biomass. Technical and economic aspects of microbial conversion processes. Inden, P.P. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Biophysikalische Chemie 2). *Elektrotech. Z., A;* **99**: No. 6, 351-355(Jun 1978). (In German).

Biosubstances, i.e. organic material, can be converted into a useful energy form from refuse or other sources of energy. In particular, fermentation methods promise success in the future, since they give products which can be stored or transported viz. methane or ethanol. Generating energy from refuse is of local importance only, due to the small amounts available. But it may be economic from the point of view of protection of the environment. The cultivation of plants as energy sources and their subsequent conversion into high-quality fuels, preferably liquid, would appear in countries with much sunshine and sparse population to be logical for the supply of energy in quantity. The costs are then higher by a factor of 2 to 3 than present energy prices for fossil fuels, but are realistic from the point of view of future development.

7599 Thermal analysis of forest fuels. Shafizadeh, F.; DeGroot, W.F. (Univ. of Montana, Missoula). pp 93-114 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

With the recent development of a quantitative method of TEA (thermal evaluation analysis) current techniques of thermal analysis can provide the data necessary for accurate evaluation of material and energy balances in pyrolysis or combustion. The net energy available from combustion processes is reduced by 250 to 300 cal/g in correcting the heat of combustion to the reaction temperature and by a similar quantity in accounting for the heat of preignition of the fuel. In pyrolysis, the energy content of the fuel is distributed to varying degrees between the char and volatile fractions depending on the composition of the fuel and the reaction conditions employed. Volatilization is enhanced by high carbohydrate and extractive content in the fuel and elevated reaction temperatures. Thermal analysis provides the fundamental data necessary for evaluation and characterization of biomass as fuel and formulation of thermal conversion processes.

7600 Pyrolysis—gasification—combustion process: energy effectiveness using oxygen vs. air with wood-fueled systems. Brink, D.L. (Univ. of California, Berkeley); Thomas, J.F.; Faltico, G.W. pp 141-168 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The pyrolysis-gasification-combustion system, designed at the University of California, is compared with a direct wood combustion system for the generation of steam and power. The mass and energy balances for both systems were calculated. The process efficiency for the PGC is higher for both steam and power generation. The economic viability of the system will depend on the capital costs of equipment which have not been estimated. (JSR)

7601 Wood oil from pyrolysis of pine bark-sawdust mixture. Knight, J.A.; Hurst, D.R.; Elston, L.W. (Georgia Inst. of Tech., Atlanta). pp 169-195 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The oils produced by pyrolysis of a pine bark-sawdust mixture have been characterized and tested by a variety of methods. The oils, as produced, contain approximately 15% or less water, which is well dispersed. The heat values of the oils vary from about 60 to 70% of the heating values of fuel oils on a volume basis. The oils contain essentially no sulfur, and therefore do not create any sulfur emission problems when burned as a fuel. The tests for oil samples stored eight months at 0°C and ambient temperature indicate that no significant changes occurred which would affect the use of the oil as a fuel. The oils are acidic and exhibit some corrosive properties. The viscosity of the oils increased with prolonged heating at 110°C, and this factor would have to be considered in the handling of the oil. Also, the oils start to degrade and decompose when heated to approximately 200°C. The oils contain a fair percentage of oxygen mixtures with a large number of components as shown by liquid chromatographic analysis. It is reasonable to assume that many of the components are oxygen containing compounds.

7602 Prospects for co-generating of steam and power in the forest products industry. Johanson, L.N.; Sarkanen, K.V. (Univ. of Washington, Seattle). pp 197-212 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Advantages of co-generation of steam and power in the wood products industry, using either direct combustion of wood wastes or pyrolysis, are outlined. The present status of energy use and possible energy conservation measures are indicated. A conceptual design is given for an integrated wood products and pulp and paper complex with a gasification-power generation system. (JSR)

7603 Design of a large-scale manure/methane facility. Varani, F.T. (Bio-Gas of Colorado, Arvada); Burford, J.; Arber, R.P. pp 275-288 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The evolution of the design of a large-scale anaerobic digestion facility to produce methane from feedlot manures in Lamar, Colorado, is described. The methane will be used by the electric power plant. Design criteria included capacity to handle from 75 to 145 tons/day on a dry weight basis and the recycling of as much water as possible. The components described are the mix and grit removal facilities, digestion complex (anaerobic digestors, heat exchange system, and gas handling and conditioning), degasification and dewatering systems, and the algae ponds. Preliminary capital and operating costs are reported. (JSR)

7604 Energy recovery from municipal wastes. Greco, J.R. (National Solid Wastes Management Association, Washington, DC). pp 289-312 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The various technologies developed to recover energy from wastes have been categorized into four generic types: steam generation, pyrolysis, mechanical fuel preparation, and landfill gas recovery. The status of technology development and application of these four types are discussed, and each type is described in some detail. The energy potential of municipal solid wastes is assessed. (JSR)

7605 Wood-to-oil process. Friedman, S. (Pittsburgh Energy Research Center); Mehta, A.S.; Thigpen, P.L. pp 3.168-3.173 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Pilot plant conversion of wood to oil is described. The process involves reacting CO with wood in the presence of a sodium carbonate solution as a catalyst at 700°F and 4000 psig. Information is included on wood drying and grinding, process feeding systems, reactor off-gases, and oil recovery. (JRD)

7606 Biochemical sources of fuels. Keenan, J.D. (Univ. of Pennsylvania, Philadelphia). pp 4.5-4.11 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Fuels are considered that are elaborated or otherwise rendered available by living systems. The discussion follows this general outline—photosynthesis to organic matter, photosynthesis to hydrogen, and biochemical conversion of organic matter to fuels. Several other topics are discussed briefly, including the microbiological extraction of shale oil, conversion economics, and the application of biochemical engineering principles to fuel generation. Cross references at the end of this discussion are given to other areas of this Handbook where some of these topics are covered in even greater detail. (JRD)

PROPERTIES

REFER ALSO TO CITATION(S) 7339, 7345, 7579, 8554, 8575, 8576, 8577, 8578, 8579, 8580, 8581, 8582, 8583, 8946

7607 (CONF-771175—, pp 1.4.1-1.4.21) **Objectives and key-points of alcohol fuel research activities in the Federal Republic of Germany.** Plassmann, E. (Technischer Uberwachungs-Verein Rheinland e.V., Cologne). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Throughout the entire transport and traffic scene in the Federal Republic of Germany it is the motor vehicle traffic that is playing the predominant part. Its efficiency is an essential prerequisite for satisfying the mobility demands and ensuring maintenance of our population. At the same time, the automobile industry is a vital economic factor in our country. Present forecasts indicate that the importance of motor vehicle traffic will increase even further during the next years so that to safeguard energy supply in this area will be a major concern in future, especially under the impression of an increasing shortage of mineral oil resources. These are the reasons why the Federal Ministry for Research and Technology established a research program specifically concentrated on "Alternate Fuels" within the "Motor Vehicles and Road Traffic" research scheme. This report covers the extent, status and future objectives of this research area.

7608 (CONF-771175—, pp 1.5.1-1.5.13) **Possibilities for cost-effective use of alcohol fuels in Otto engine-powered vehicles.** Bernhardt, W. (Volkswagenwerk A.G., Wolfsburg, Ger.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Technical, economic, and logistic aspects of the introduction of alcohols (methanol or ethanol) as an alternative automotive fuel are discussed. The energy conversions obtainable are cited from experimental data. The economic aspects discussed include production costs, cost effectiveness of alcohols, changeover costs, and cost relationship of alcohol to gasoline. New engine concepts for the utilization of pure alcohol fuels are briefly discussed. (JSR)

7609 (CONF-771175—, pp 2.1.1-2.1.5) **Tests on unleaded gasoline containing 10% ethanol: Nebraska GASOHOL.** Scheller, W.A. (Univ. of Nebraska, Lincoln). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

On December 23, 1974, a 2 million mile (3.2 million km) road test program involving 45 Nebraska owned vehicles was begun to compare an unleaded fuel blend containing 10 percent anhydrous ethanol (GASOHOL) with regular grade unleaded gasoline. Odometer reading and quantity of fuel added were recorded at each fueling stop. Spark plugs were examined and compression measurements were made periodically. The engine heads were also removed from ten cars, the valves and valve seats examined and micrometer measurements of the cylinder diameter were made. Standard emissions tests were conducted at the ERDA Energy Research Center in Bartlesville, Oklahoma. Total emissions from GASOHOL were about 15.7 gm/mile lower than from unleaded. The GASOHOL cars obtained up to 5.3 percent more miles per gallon and 8.7 percent more miles per Btu than the cars using unleaded fuel. GASOHOL performance was satisfactory under all conditions of weather and driving.

7610 (CONF-771175—, pp 2.2.1-2.2.8) **Factors that improve the performance of an ethanol-diesel oil dual-fuel engine.** Panchapakesan, N.R.; Gopalakrishnan, K.V.; Murthy, B.S. (Indian Inst. of Tech., Madras). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Some of the factors which affect the performance of an alcohol-diesel oil dual-fuel engine, in which alcohol forms the principal fuel, are investigated. The aim is to achieve the maximum use of alcohol with the best possible thermal efficiency and output. The chief problems of this type of engine are identified and remedial measures explored. The effectiveness of injection timing, compression ratio and ignition accelerating additives to alcohol in achieving the above aims have been investigated. The performance of the engine has been assessed on the basis of thermal efficiency, degree of use of alcohol, combustion characteristics and exhaust emissions. The results show that it is possible to derive as much as 70 to 80 percent of the total heat requirement of the engine from alcohol for most of the load range. Possibilities of further improvement are also indicated by the results.

7611 (CONF-771175—, pp 2.3.1-2.3.22) **Problems in the application of ethanol as fuel for utility vehicles.** Bandel, W. (Daimler-Benz A.G., Stuttgart). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The use of ethanol as engine fuel from plant-sources is of special interest to petroleum-poor countries with advantageous climatic conditions and sufficient planting space. No noteworthy difficulties are to be expected in this connection for the operation of Otto-type engines. More problematic is the application of ethanol to utility vehicles that are originally operated with diesel engines. Two approaches to the solution, that are different in principle are discussed: The adaptation of the engine to the substitute-fuel ethanol and the adaptation of substitute-fuel to a diesel engine that is as unchanged as possible. The advantages and disadvantages of the individual methods must be weighed with a special view to the economy of the utility vehicles.

7612 (CONF-771175—, pp 2.4.1-2.4.7) **Methanol as a substitute fuel in the diesel engine.** Holmer, E. (AB Volvo, Goteborg). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Development work has been carried out to investigate ways of converting a conventional turbocharged diesel engine in service for the use of methanol in the event of diesel fuel being in short supply. The main problem is the very low cetane rating of methanol, which makes ignition by compression difficult and the limited possibility to rebuild a truck in service. Two paths have been studied, additives to increase the cetane rating and forced ignition. The dual fuel diesel engine has been selected as the best compromise and will be studied further.

7613 (CONF-771175—, pp 2.5.1-2.5.6) **Dual fuelling the truck diesel with methanol.** Cummings, D.R. (D.U.T. Pty Ltd., Sydney); Scott, W.M. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Methanol is considered to be an attractive alternative fuel for power generation in the context of diminishing oil reserves. An investigation of the extent to which methanol could replace normal diesel fuel in truck type engines has been conducted. Using the dual fuel principle it is shown that the substitution rate is limited by both quench and knock. Techniques such as mixture heating and ignition promoting additives allow greater substitution but would result in unacceptable complexity of control in transient operation. Explanations are offered for the adverse effect of methanol on the unexpected extension of ignition delay of the pilot fuel. It is concluded that diesels running at constant speed offer the better market for dual fueling with methanol.

7614 (CONF-771175—, pp 2.7.1-2.7.8) **Utilization of methanol as a automotive fuel: a report from IIEC-2, the Inter-Industry Emission Control Program.** Baker, R.E. (Ford Motor Co., Detroit); Harrington, J.A.; Baudino, J.H.; Copeland, L.C.; Koehl, W.J.; McCabe, L.J.; Wotring, W.T. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Three approaches for utilizing methanol have been investigated: in its neat form, as a blend in gasoline, and in a dual-fuel system in which it is added at the carburetor for power enrichment. Data are presented on pre-vaporization experiments and aldehyde emission measurements with neat methanol; on driveability and 80,000 km durability tests with blends; and on performance and durability of a dual-fuel demonstration vehicle. In addition, data are given on the effect of methanol blends on laminated Fiberglas materials used in gasoline storage tanks.

7615 (CONF-771175—, pp 3.1.1-3.1.18) **Process methods and working costs for making methanol available as a carburetor fuel in the Federal Republic of Germany (BDR): a consideration on possible raw materials and locations for installations.** Mundo, K.J. (Uhde GmbH, Dortmund, Ger.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Possible raw materials for the production of methanol in the German Federal Republic and the economics of methanol production are evaluated. The analysis shows that the substitution of

methanol for gasoline or blending methanol with gasoline for automotive fuels is economically unattractive. (JSR)

7616 (CONF-771175—, pp 4.1.1-4.1.22) **Effect of blending methanol with gasoline on the lean misfire limit of a multicylinder carbureted engine.** Chester, K.A. (Univ. of Miami, FL); Adt, R.R. Jr.; Rhee, K.T.; Pappas, J.M.; Swain, M.R. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

A four cylinder carbureted engine was fueled with Indolene (gasoline) and a blend of Indolene and 20 percent by volume methanol to determine the effect of the blend on the lean misfire limit (LML). Several LML detection methods were used including measurement of exhaust hydrocarbon, in-cylinder pressure, exhaust blowdown-pulse pressure and audible misfire. The results show a small extension of ignition failure-induced (IFI) LML for the blend. The presence of fuel droplets in the combustion chamber at the time of ignition with methanol and methanol blends is offered as a potential cause of the extended IFI LML found with these fuels.

7617 (CONF-771175—, pp 6.5.1-6.5.20) **Investigations on the course of combustion on methanol operation.** Pischinger, F.; Kramer, K. (RWTH, Aachen). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The influence of compression ratio, air ratio, ignition timing and RPM were investigated in respect of the course of combustion, effective combustion period and total combustion period on a one-cylinder, four cycle Otto-type engine. It was shown that the course of combustion and the effective combustion time are shorter with methanol than with gasoline at equal compression and that the combustion duration is shortened by increasing compression. In contrast to this, the effective combustion period is somewhat extended by an increase in compression. The maximum values of the reaction rate with methanol are higher than those of gasoline. With methanol operation with a compression of 9.3, the maximum values are higher than in the compression ratios of 12.3 and 14.5. The effects of the course of combustion result in somewhat higher peak pressures at equal compression for methanol. The peak pressures increase with increased compression. The peak pressure variations show the same tendency. The variation coefficient of the peak pressures in this case hardly varies with increasing compression. With increasing RPMs, the combustion delay extends itself in the known manner in the crank angle measure in gasoline and methanol operation, while the effective combustion period in the crank angle measure remains approximately constant.

7618 (CONF-771175—, pp 6.6.1-6.6.8) **Evaporation of methanol droplets impinged upon a hot surface.** Karasawa, T.; Kurabayashi, T. (Gunma Univ., Kiryu, Japan). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The droplets of methanol and its water solution are dropped upon a heated metal surface with various speeds and their lifetimes are measured. The lifetimes are plotted against the surface temperature which covers nearly from 30 to 450°C. There are two well-known particular points on the lifetime curve, the minimum lifetime point M and the Leidenfrost point L. Besides them, a new particular point where lifetime is discontinuously decreased is found in a slightly heated temperature region. The effects of impinging velocity of a droplet on its lifetime, on the broadness of temperature region of the minimum lifetime and on the position of M and L are examined using several kinds of methanol-water solution. The influences of thermal properties of the surface metal on the vaporization of the droplet are also examined. The results have presented some suggestions to obtain short evaporation time and a wide minimum time zone.

7619 (CONF-771175—, pp 7.1.1-7.1.9) **Gasoline-methanol fuels; blending optimization with respect to manufacturing economics and engine performance.** Hooks, R.W.; Reders, K.H.; Regilitzky, A.A. (Deutsche Shell AG, Hamburg). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Previous studies have shown that the addition of methanol to current motor gasolines and its use in todays car population could be disadvantageous from fuel manufacturing and handling, and also engine performance points of view, if such fuels are not carefully formulated. A joint Volkswagenwerk-Shell engine/fuels development programme, sponsored partially by the German Federal Ministry of Research and Technology, is at present being carried out to study the whole subject. Initially premium and regular type blends have been prepared for various European refinery concepts i.e., hydroskimming, conversion and petrochemical. Components which these types of refineries can produce economically have been used to formulate candidate methanol containing fuels. Although these fuels do not meet current gasoline specifications, certain quality aspects such as antiknock performance and composition stability had to be ensured as only slight modifications to the engines, will be possible in the short-term. Laboratory studies with respect to antiknock performance, composition stability and analytical performance parameters, as well as tests with current and modified cars and their effects on fuel composition are described in this paper. The results given here and the results from further optimization programmes will give guidelines for future quality requirements, should the need for widespread addition of methanol to automotive fuels ever arise.

7620 (CONF-771175—, pp 7.3.1-7.3.8) **Modification of methanol fuel for highway vehicles.** Keller, J.L.; Nakaguchi, G.M.; Ware, J.C. (Union Oil Co. of California, Brea). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Some of the problems that would be encountered if methanol were widely used to fuel highway vehicles could be solved or alleviated by modifying the fuel. In this paper progress to date in an on-going study of fuel modification undertaken for the United States Energy Research and Development Administration (ERDA) is discussed. The study covers methanol use both in blends with gasoline and alone or in fuels where it is the major component. Bench scale tests used to study cold startability, warm-up driveability and vapor locking characteristics are described. Results of studies of various fuel modifications designed to overcome problems with water contamination, cold starting and vapor lock are presented. Means for reducing the hazards associated with the toxicity, vapor explosivity and low flame visibility of methanol are also discussed.

7621 (CONF-771175—, pp 8.1.1-8.1-5) **Toxicological aspects of alcohol fuel utilization.** Moriarity, A.J. (Biomedical Resources International, Toronto). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Based on current reviews of the inherent toxicities of methanol, ethanol and related liquid fuels, the biomedical impact of large-scale synthesis, volume transport and widespread handling can be projected. This should include further examination of the technological peculiarities of fuel alcohol production and prospects for further conversion or reconversion. Point-of-use handling and mishandling dangers, occupational, environmental and emission hazards must be studied. Any human cost/technological benefit analysis must include the comparative assessment of dangers associated with present or competitive liquid fuels, prospective fuel additives and projected alcohol fuel uses. All available evidence would indicate that alcohol fuel options offer certain environmental and biomedical benefits that should be taken into full consideration.

7622 (CONF-771175—, pp 8.2.1-8.2.7) **Methanol and ethanol fuels: environmental, health, and safety issues.** Hagey, G. (Dept. of Energy, Washington, DC); Parker, A.J. Jr.; Raley, D.L.; Timbario, T.J. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

A considerable amount of R and D is being applied to the characterization and quantification of motor vehicle exhaust emissions resulting from the combustion of methanol and ethanol fuels. Likewise, several organizations, including the U.S. Department of Energy, recognize the need to investigate additional environmental, health and safety concerns related to the commercial distribution and public utilization of these fuels. This paper discusses the research needs required to ensure that the distribution and utilization of methanol and ethanol fuels will be environmentally acceptable. It does not result in a compendium of environmental, health and safety research projects, but rather highlights specific areas where information is lacking, and informs researchers of those socially-oriented aspects which need to be considered a part of and in parallel with the alcohol fuels implementation process.

7623 **Methyl alcohol: a potential fuel for transportation.** Pasternak, A. (Univ. of California, Livermore). pp 4.44-4.49 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Methanol is attractive as an alternative transportation fuel because it is a liquid and is therefore easy to handle and because it

can be made from coal with known technology. A number of reports describe operating experience for cars running on methanol-gasoline blends and also neat methanol. At a limit of 10 to 15 percent methanol in gasoline, no modifications are necessary to the carburetion of existing automobiles although late model cars may suffer some loss of performance. For operation on pure methanol, several modifications are necessary: carburetors must be rejetted to lower the air/fuel ratio, and exhaust heat must be recycled to compensate for methanol's lower energy content. Operation of vehicles on pure methanol has some potential advantages: 1. Methanol has a high octane rating which may permit increases in engine compression ratios and higher efficiencies. 2. There are data which show that existing engines can operate at higher efficiencies on methanol than on gasoline. 3. Methanol's high heat of vaporization makes possible the recycle of exhaust heat and should lead to higher thermodynamic efficiency. 4. There are data which show that emissions of CO, NO/sub x/, and unburned hydrocarbons are lower when cars are operated on methanol than on gasoline.

PREPARATION

REFER ALSO TO CITATION(S) 7615

CHEMICAL SYNTHESIS

REFER ALSO TO CITATION(S) 7204, 7390

7624 (CONF-771175—, pp 3.2.1-3.2.21) **Production of methanol from Rhine lignite.** Franke, F. (Rheinische Braunkohlenwerke A.G., Cologne); Nitschke, E. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

In view of the raw materials situation of the Federal Republic of Germany, gasification of coal, especially of Rhein lignite, will gain in importance increasingly also for the production of methanol. The Winkler "whirling bed"-process is especially suited for the gasification of lignite. A further development of the conventional Winkler process toward higher temperatures and higher working pressures, the High Temperature Winkler process (HTW) is explained and the stand of its development is briefly presented. A process concept for a major installation for the production of methanol from Rhine lignite on the basis of HTW-coal gasification is introduced, whereby specific problems in the working of the coal as raw material will be especially discussed.

7625 (CONF-771175—, pp 3.4.1-3.4.6) **Use of a floating methanol plant to develop remote offshore gas reserves.** Jackson, R.G. (Continental Oil Co., Ponca City, OK). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Early in 1976 a joint study group was established between the Mitsui group of companies consisting of Mitsui and Co. Ltd., Mitsui Engineering and Shipbuilding Co. Ltd., and Toyo Engineering Corporation; and Continental Oil Company, to make a technical and economic study of building a 2,000-metric-tonnes-per-day methanol plant, on a used tanker or a new barge, as a means of developing gas reserves in remote areas. The paper will present the results of the study which is based on the development of a gas supply offshore southeast Asia, but with some modifications is equally applicable to any remote gas reserve offshore or onshore near to the sea. Briefly, the paper contains descriptions of: (a) the gas delivery system; (b) the comparison of converting a used tanker with building a new barge; (c) the barge-mounted plant; (d) the transportation requirements and costs; (e) the economics; and (f) the potential uses.

7626 (CONF-771175—, pp 3.5.1-3.5.4) **Catalytic production and mechanism of formation of methyl fuel.** Laux, P.G. (Vulcan Cincinnati, Inc.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Vulcan Cincinnati, Inc., early realized that methanol or methanol containing defined quantities of other alcohols including ethanol, propanol and butanol ("Methyl Fuel") could play a major role in energy programs seeking an alternative fuel to conventional fuels in gasoline engine, turbine, and boiler applications. This paper will describe Vulcan's efforts to develop "Methyl Fuel" technology with emphasis on the necessity to tailor catalysts to yield a final product meeting the specific requirements of the producer. The laboratory and pilot plant work carried out to date clearly shows that in addition to methanol, predominant species produced are ethanol, n-propanol and iso-butanol. Various reaction mechanisms have been offered to describe the formation of alcohols other than methanol. These will be described with the emphasis placed on that mechanism which Vulcan Cincinnati, Inc. believes to be predominant. The influence of operating parameters including temperature, pressure, space velocity and gas composition on the final product are discussed.

7627 (CONF-771175—, pp 3.6.1-3.6.14) **Methanol synthesis and possibilities for production of fuel-methyl.** Baron, G.; Moller, F.W.; Supp, E. (Lurgi Kohle und Mineraltechnik, GmbH, Frankfurt am Main). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The process-technological characteristics of the Lurgi-Low-Pressure methanol process are shown. It is explained, how methanol synthesis can be combined with the installations for the production of methanol, starting with gaseous, liquid and solid fuels, whereby economical aspects of the individual process variations are especially discussed. It is further shown what possibilities exist for the production of methyl fuel—a mixture of methanol and higher alcohols. Further, a process for the conversion of methanol into gasoline that is in the process of development is also pointed out.

7628 **Utilization of low Btu natural gas.** Weisz, P.B.; Zahner, J.C. (to Mobil Oil Corp.). US Patent 4,098,339. 4 Jul 1978. Filed date 13 Oct 1976. 6p.

Natural gas of low heating value, high CO content, is converted to valuable products by the combination process of steam reforming the desulfurized gas, subjecting the effluent of the steam reformer to a water gas shift reaction and converting the resultant carbon dioxide, the unreacted carbon monoxide and hydrogen to liquid product useful as fuel, e.g., methanol. In a preferred embodiment, the gas phase separated from the liquid fuel products is processed to provide a gas sufficiently rich in carbon dioxide for use in tertiary recovery of petroleum from natural reservoirs which have produced the quantity of oil available by natural drive.

7629 **Methanol production and fuel methanol vs. LNG.** Humphreys, G.C. (Davy Powergas Ltd., London). pp 2.120-2.128 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Methanol is compared economically and technically with LNG as a fuel. Information is included on methanol production, fuel methanol plants, economic tradeoffs with LNG, and methanol uses.

PREPARATION FROM WASTES OR BIOMASS

REFER ALSO TO CITATION(S) 7598, 7606, 7683, 7684

7630 (CONF-771175—, pp 5.3.1-5.3.8) **Basic data on continuous alcoholic fermentation of sugar solutions and of mashes from starch containing raw materials.** Engelbart, W. (Schumacher'sche Fabrik, Bietingheim-Bissingen, Ger.); Dellweg, H. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Continuous alcoholic fermentations are shown to be preferably one stage processes. It was found that the specific yield of ethanol (based upon the fermented sugar) can be about 98 percent of the theoretical value compared to about 93 percent yield in normal batch processes. Continuous fermentation of enzymatically saccharified starch containing raw materials is limited by the saccharification rate and takes about 40 hours fermentation time. Fermentation of clarified beet or cane juices only needs 6 hours fermentation time. Scale-up is no problem. The process does not need sterile conditions because bacteria do not have a chance for considerable growth and because of selective conditions for growing and fermenting yeast.

7631 (CONF-771175—, pp 5.1.1-5.1.4) **Production of ethanol by the fermentation of grain.** Scheller, W.A. (Univ. of Nebraska, Lincoln). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

After about 1945 ethanol produced from ethyl sulfate and ethylene replaced fermentation ethanol in the U.S. industrial chemical market because it could be produced at a lower price. The current price of OPEC oil in the U.S. is about 4 times that in 1972 with the result that ethanol produced by grain fermentation again appears to be competitive in the industrial market if produced in large plants (20 million gallons per year or larger). An economic evaluation of the profitability of the production of 20 million (75.8

million liters) per year of anhydrous ethanol from 21,490 bushels (546 metric tons) per calendar day of milo (a maize grain) indicates an annual rate of return above 20 percent on the total investment of $27,000,000. In larger plants the economic outlook is even more attractive. Between now and 1980 the price of ethanol from ethylene is expected to increase at a considerably greater rate than ethanol from grain.

7632 (CONF-771175—, pp 5.2.1-5.2.4) **Economical and technical aspects of ethanol production from maniok.** Schmidt-Holthausen, H.J.; Engelbert, W. (Schumacher'sche Fabrik, Bietigheim-Bissingen, Ger.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The use of solar energy for the production of alcohol fuels by agricultural and biotechnological conversion processes, is in the first place a question of economy. Using fresh maniok and the common technology of today, only a small net-yield of energy can be attained. The aspects of an ethanol-plant, to be built in Mato Grosso, Brazil, are discussed. Continuous process techniques are proposed and some alternative solutions for economizing "waste" treatment are given.

7633 (CONF-771175—, pp 5.4.1-5.4.7) **Direct production of ethanol from sugar cane.** Rudolph, K. (German Society for Technical Cooperation (GTZ), Eschborn) Osianowski, R.P.; Tentscher, W. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

This report concerns a new process for the production of ethanol as fuel additive or either substitute from sugar or starch-containing plants. The new process is based upon a steaming process at 110°C of the plant material that has been size-reduced in a hammer mill. The material is subsequently extracted. The sugar-containing juice is then treated as usual. Unripe ("young"), overripe, frost-damaged and poor-quality sugar cane, sorghum etc. can be utilized. The installations can operate independent of existing sugar factories. In 1978, a pilot installation with a daily production of 3000 liters will be erected in a Latin American country. Reference is further made to a second, simpler, process in which the size-reduced material is fermented without juice extraction.

7634 (CONF-771175—, pp 5.5.1-5.5.6) **Direct processing of sugar cane into ethanol.** Bruschke, H. (Balweg Gastechnik GmbH, Bonn). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

In order to be able to avoid the use of roller mills for the direct processing of sugar cane into ethanol, a process has been developed that liberates the sugar by the influence of elevated temperature. The size-reduced cane is heated by the introduction of steam, subsequently fermentation can take place as well without separation of solids and solution, or the sugar can also be washed out practically completely by a much-simplified extraction process. The sterile sugar solution that is so obtained is fermented without further treatment.

7635 (CONF-771175—, pp 5.6.1-5.6.9) **Energetics, economics, and prospects of fuel alcohols in Brasil.** de Carvalho, A.V. Jr.; Milfont, W.N. Jr.; Yang, V.; Trindade, S.C. (Centro de Technologia Promon, Rio de Janeiro). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Brazil is no exception in the world to the increasing energy consumption. The shortage of oil and natural gas has induced an intensive search for alternative liquid fuels. An analysis is made of the potential availability and uses of ethanol and methanol in the Brazilian context in the light of the Government programs to substitute petroleum derived fuels for domestic sources. Fermentation ethanol has long been blended to gasoline for automotive uses. Emphasis is placed on the potential utilization of this alcohol as a transportation fuel, in the short term. Alcohols will probably not be used as utilities fuels in Brazil for economic considerations. A net positive return on energy investment is shown to be achieved for cassava and sugar cane ethanol production. The economics reveal disadvantageous costs as compared with the price fixed by the Government. However, expected improvements in both agricultural and industrial technologies, increase of imported oil price and perhaps internal political decisions can make fermentation ethanol more competitive.

7636 (COO—4225-1, pp 1-12) **Systems stuy of sugarcane, sweet sorghum, sugar beets, and corn for fuels and chemical feedstocks.** Lipinsky, E.S. (Battelle Memorial Inst., Columbus, OH). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

Speculative results obtained in the economic analysis of the potential of sugarcane, sweet sorghum, sugar beets, and corn for fuels and chemical feedstocks are summarized. Estimated production costs for ethanol and ethylene are given. Possibilities of ammonia production are indicated. Research and development needs in the Fuels from Biomass Program are tabulated. (JSR)

7637 (COO—4225-1, pp 115-144) **Production of sugars and ethanol based on the enzymatic hyrolysis of cellulose.** Wilke, C.R. (Univ. of California, Berkeley). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

Hydrolysis of cellulose by acids and enzymes is discussed from the viewpoint of producing fermentable carbohydrates. Particular emphasis is given to recent developments and problems of enzymatic hydrolysis. Tentative processing schemes for producing ethanol from cellulosic materials are described. Plant biomass consists primarily of carbohydrate polymers, lignin and small amounts of ash and extractives. The carbohydrate fraction can be characterized in various ways depending upon the methods of analysis and the chemical degradation which may be caused by the separation methods employed. For the purpose of the present discussion, the carbohydrate content of plant biomass will be viewed simply as consisting of cellulose (more correctly alpha-cellulose) and hemicellulose. Cellulose is a polymer of D-glucose having a degree of polymerization in the range of several thousand with the glucose units linked at the beta, 1-4 position. Hemicellulose is primarily a polymer of xylose having a lower degree of polymerization in the range of several hundred. Lesser amounts of other hexoses such as mannose and of other pentose such as aribinose are often present. Soft woods typically contain 65 to 73% total carbohydrate with 10 to 13% pentosans. Hardwoods typically contain 70 to 82% carbohydrate with 18 to 25% pentosans. The objective of the present paper is to review briefly some methods for obtaining carbohydrates and to discuss some engineering and economic aspects of the utilization of plant biomass as a fermentation raw material. The discussion will emphasize the enzymatic hydrolysis of cellulose in which we have been engaged at Berkeley. Acid hydrolysis will be discussed briefly as an alternative processing method.

7638 (COO—4225-1, pp 145-150) **Fuels and petrochemical substitutes from fermentation of biomass.** Bungay, H.R. (Rensselaer Polytechnic Inst., Troy, NY). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The research programs sponsored by DOE on the fermentation of biomass to ethanol and other fermentation products are briefly described. These include research on sugars or ethanol from cellulosic wastes, high cellulase mutants, the use of other organisms with the production of additional products, and thermophillic processes. (JSR)

PREPARATION

REFER ALSO TO CITATION(S) 7390

SOLID WASTE FUELS

REFER ALSO TO CITATION(S) 7599, 7602, 7604, 8436, 8437, 8795

7639 (COO—4225-1, pp 163-172) **Direct combustion of silvicultural biomass.** Zerbe, J.I.; Arola, R. (Forest Service, Washington, DC). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The combustion of residues from forest products industry in order to make the industry more energy independent is discussed. The types of combustion equipment available for combustion are field-erected boilers, packaged units, and special combustors. These are described and combustion equipment costs are estimated. The material flow and energy requirements in a typical pulp/paper plant are evaluated. A site-specific study to determine the feasibility of supplying its energy requirements from the residues is planned. (JSR)

7640 (TID—28550) **Sugarcane production residues: technologic and economic assessment of methods for conversion to utilizable energy forms. Final report.** Nordstedt, R.A.; Smith, P.H.; Bagnall, L.O.; le Grand, F. (Florida Univ., Gainesville (USA). Inst. of Food and Agricultural Sciences). 1976. 82p. Dep. NTIS, PC A05/MF A01.

This report examines the technologic and economic feasibility of converting sugarcane production residues in South Florida to utilizable energy forms. Quantity and location of the residues are given. Current uses of the residues are outlined and compared with other potential uses which are described in the literature. Technological problems in collection of the field residues are discussed. The resulting research and development needs are outlined. An in-depth economic comparison of anaerobic digestion, shaft pyrolysis, and waterwall incineration is presented. Economic feasibility of each of the three processes is presented as a function of plant size using current market prices for energy and the energy price increases which would be necessary to make each of the processes economically feasible.

7641 **Fuels and energy from renewable resources.** Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977). 351p. (CONF-770814—). $39.00.

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The sixteen papers and the consensus of the general discussion are compiled. Separate abstracts were prepared for each paper. (JSR)

7642 **Conversion of stagnated timber stands to productive sites and use of noncommercial material for fuel.** Zerbe, J.I. (Forest Products Lab., Madison, WI). pp 115-123 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The prospects of using residual wood material for fuel offers the potential of an income source to help pay for the removal of unproductive stagnated timber stands. Potential location of deteriorated stands are identified with emphasis on insect-damaged forest stands in the West and shrubby hardwoods in the South. Potential users of residue fuels are power-generating plants and process steam producers or cogeneration of steam and electricity. An example is given of an economic analysis for such installations. Current and planned studies and demonstrations of wood-burning installations are summarized. (JSR)

7643 **Industrial wood energy conversion.** Voss, G.D. (American Fyr-Feeder Engineers, Des Plaines, IL). pp 125-140 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Experience gained in the direct combustion and in the gasification of wood as sources of industrial fuel is reported. The equipment available for the two processes are described and compared on the basis of reliability and economics. Direct combustion has its primary application in a new installation or a compatible retrofit situation. Gasification offers more potential for a retrofit application on existing oil or gas-fired boilers. (JSR)

7644 **Feasibility of utilizing crop, forestry, and manure residues to produce energy.** Alich, J.A. Jr.; Schooley, F.A.; Ernest, R.K.; Miller, K.A.; Louks, B.M.; Veblen, T.C.; Witwer, J.G.; Hamilton, R.H. (Stanford Research Inst., Menlo Park, CA). pp 213-224 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Technology and economic assessments were made for ten specific sites in the United States. The economics of combustion by utilities for power production or co-generation appeared competitive in Sutter, California, as did the production of SNG. Other industrial use does not appear feasible. Some of the projects that are feasible for the other areas are listed. (JSR)

7645 **Bagasse as a renewable energy source.** Arlington, W. (Florida Sugar Cane League, Inc., Clewiston). pp 249-256 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The combustion of bagasse to supply steam and electric power for the production of raw sugar from sugar cane is described. The types of boilers used, the boiler operation, and the particulate emission control are discussed. No sulfur dioxide control is needed as bagasse contains only trace amounts of sulfur. It is estimated that bagasse combustion supplies approximately 66% of the energy demand of the cane sugar industry. (JSR)

7646 **Use of ginning waste as an energy source.** Lalor, W.F. (Cotton Inc., Raleigh, NC). pp 257-273 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Studies were made at two cotton gins to determine if the combustion of the ginning wastes could supply sufficient heat to dry the cotton. The gins used heat-recovery waste incinerators, one recovering 10 to 15% and the other 40% of the heat. The gin with the 40% heat recovery recovered sufficient heat for drying the cotton under almost any circumstance. In the other gin supplemental heat was required. An economic analysis showed that the capital investment of heat-recovery incinerators would probably be justified when the combined cost of purchasing fuel and disposing of wastes exceeds $1.50 per bale.

7647 **Energy from waste materials: 1977 overview.** Schlesinger, M.D. pp 313-331 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Approaches to the problem of the disposal of municipal solid wastes and other municipal wastes are summarized. The special problems in the combustion of agricultural and forestry wastes are indicated. The provisions of the Resource Conservation and Recovery Act are briefly reviewed and their impact on waste disposal indicated. (JSR)

7648 **Discussion of critical issues.** Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. . pp 333-339 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L.(eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The four major questions considered in the general discussion were: (1) the drying of biomass fuels prior to combustion, (2) the use of biomass fuels in non-integrated papermaking plants, (3) the environmental impacts of pyrolysis, and (4) the practicality of energy plantations. In addition a presentation was made on biomass energy utilization in Brazil. The discussion consensus and presentation on Brazilian biomass energy use were summarized. (JSR)

HYDRO ENERGY

RESOURCES AND AVAILABILITY

REFER ALSO TO CITATION(S) 8428

PLANT DESIGN AND OPERATION

7649 (IDO—1962-1) **Report on turbogenerating equipment for low head hydroelectric developments.** VerPlanck, W.K.; Wayne, W.W. Jr. (Stone and Webster Engineering Corp., Boston, MA (USA)). Apr 1978. Contract EG-77-C-07-1692. 172p. Dep. NTIS, PC A08/MF A01.

The current status of the evaluation of certain selected turbogenerating equipment suitable for low-head hydroelectric plants is reported. Pertinent information available in the Stone and Webster Engineering Corporation files concerning the design, fabrication, installation, testing, and operation of bulb type units is summarized. Most of this information was obtained in connection with the preliminary planning, detailed design, and construction of the new Second Powerhouse at the Rock Island Hydroelectric Project. The cross-flow turbine manufactured by the Ossberger Turbine Works in Weissenburg, Germany, was investigated, as was the Straflo type unit, with rim mounted generator, which is manufactured by Escher Wyss, Ltd., of Zurich, Switzerland. This work included visits to several hydro stations on the Lech River, Germany, where the largest size Straflo units built to date are in operation. The low-head Micro-Hydel Units and Mini-Hydel Units now being developed by Barber Hydraulic Turbine Ltd. of Port Colborne, Ontario, in a standard range of sizes were also investigated. The Micro-Hydel Units cover very small installations of up to 50 kW, while the Mini-Hydel Units cover capacities from 50 kW to 1,000 kW, depending upon the available head. The status of the research and development program being undertaken by Allis-Chalmers Corp., York Works, to

develop standardized tubular turbines and accessory equipment for low-head hydro plants is described. Additional information about other types of equipment that might be considered for low-head hydro developments is also reported. (JGB)

7650 Large modern hydroelectric power plants in Europe and overseas. Pt. 1. Derzko, M.V. *Arch. Energiewirtsch.;* **32**: No. 4, 269-280(Apr 1978). (In German).

The article describes (partly in detail) the largest hydroelectric power stations in South America, Canada, Mexico, Spain and Norway. The constantly increasing demand for electrical power and the price increases in the world fuel market act as a stimulus to further expansion of hydroelectric power, above all in countries which have few natural supplies of fuel, but are rich in hydroelectric power. Hydroelectric power plant construction is being intensively developed in North and South America, in Asia and in Africa. The increase in size of sets and their improvement by raising the speed, the power parameters and the cavitation behaviour of the turbines all belong to the general trend in this sector. At present, more than 50 hydroelectric power stations with an output of 1 GW or more are being built and operated in the world (excluding the Soviet Union); 25 of these are in North America, 15 in South America, 5 in Africa, 4 in Asia and 3 in Europe.

7651 Bulb and STRAFLO turbines for low head power stations. Hoelier, K.; Miller, H. *Escher Wyss News;* **50**: No. 2, 3-10(1977).

The exploitation of large rivers with low head power stations continues to be economically attractive. In recent years, bulb turbines have been increasingly employed because the associated civil engineering costs are lower than for vertical Kaplan units, and their hydraulic efficiency is higher. Escher Wyss have played an important role in the development of bulb turbines, and have recently set new trends with the Straflo (straight flow) turbine. After a summary of the various types of design employed by Escher Wyss, the main features of modern bulb turbines are illustrated by a description of the world's largest bulb turbines at Racine in the USA. Finally, the development of the Straflo turbine with outer rim generator is discussed.

7652 Fatigue life of spiral casings in pumped storage casings. Grein, H. *Escher Wyss News;* **50**: No. 2, 11-12(1977).

The spiral casings of hydraulic machinery are subject, particularly in pumped storage stations, to frequent changes of mode, and thus to low frequency dynamic loadings due to internal pressure. This may cause material fatigue, which limits the durability of the component, and depends on the characteristics of the material, the number and frequency of load changes, and corrosion effects. A method of estimating loadings is described.

SOLAR ENERGY

REFER ALSO TO CITATION(S) 8494

RESOURCES AND AVAILABILITY

REFER ALSO TO CITATION(S) 7706, 8378, 8433

7653 (CONF-770998—, pp 1-13) **Network rationale for solar energy needs.** Christensen, D.; Carter, G. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7654 (CONF-770998—, pp 14-20) **Alternative solar radiation networks satellite data.** Tarpley, D. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7655 (CONF-770998—, pp 21-30) **Alternates to a ground-based solar-radiation monitoring network.** Machta, L.; Cotton, G. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7656 (CONF-770998—, pp 31-46) **State of the New Mexico solar radiation resource assessment project.** Bahm, R.J. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7657 (CONF-770998—, pp 47-56) **New York State solar network.** Stewart, R. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7658 (CONF-770998—, pp 57-63) **WEST associates solar resource evaluation project.** Patapoff, N.W. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7659 (CONF-770998—, pp 64-103) **Solar radiation energy source comparison using SOLMET data.** Terry, E.S.; Schlagheck, R.A. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7660 (CONF-770998—, pp 104-108) **Natural variability of solar radiation.** Machta, L.; Cotten, G. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7661 (CONF-770998—, pp 109-122) **NOAA/ARL solar research facility, Boulder, Colorado.** Flowers, E. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7662 (CONF-770998—, pp 123-126) **Processing and quality control of national weather service radiation data.** Seguin, W.R. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7663 (CONF-770998—, pp 127-131) **Canadian network.** Latimer, R. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7664 (CONF-770998—, pp 132-134) **Data quality control.** Carter, G. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7665 (CONF-770998—, pp 135-153) **NOAA rehabilitated and cloudiness estimated data.** Quinlan, F. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7666 (CONF-770998—, pp D.1-D.11) **Appendix : toward a new climatic regionalization of the contiguous United States.** Willmott, C.J. Nov 1977.

From 2. national solar radiation data workshop; Skyland, VA, USA (26 Sep 1977).

In Proceedings: the second national solar radiation data workshop.

7667 (COO—4094-9) **Sun-following pyrheliometer mounts for insolation data collection.** Stuart, D.G.; Much, C.H. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 2 Aug 1978. Contract EY-76-C-02-4094. 69p. Dep. NTIS, PC A04/MF A01.

The problems of insolation measurements in support of a solar photovoltaic energy program are discussed. The design and development considerations, both mechanical and electrical, are given for the first two mounts in the program. A brief description of the astronomical sun-tracking problem is provided. The design of a mount and control system specifically tailored to the gathering of insolation data using a pyrheliometer is presented.

ECONOMICS

REFER ALSO TO CITATION(S) 7710, 7731, 7733, 7770, 7771, 7783

ENVIRONMENTAL, LEGAL, AND INSTITUTIONAL ASPECTS

REFER ALSO TO CITATION(S) 7269, 7731, 7771, 8392

7668 (DOE/EV—0015, pp 57-69) **Solar, geothermal, and energy conservation.** Jun 1978.

In Division of Environmental Control Technology program, 1977.

A high priority was placed on assessing environmental problems associated with materials used in Solar Heating and Cooling with the objective of developing a document describing the flammability, toxicity, and environmental impacts of various materials used. Another high priority activity is the assessment of environmental controls needed for biomass. The geothermal program is to identify potential gaps in environmental control capabilities and to foster the timely development of control options. Studies are being conducted on state-of-the-art liquid waste control systems and gaseous cleanup systems. Energy conservation accomplishments to date include (a) an evaluation of 14,000 pages of testimony submitted for licensing a New York State high voltage transmission line as an initial assessment of environmental controls for this and similarly planned lines, (b) the demonstration of the feasibility of an active noise abatement system for transformers, and (c) the compilation of environmental regulations for siting high voltage transmission lines. An independent assessment of environmental controls within the Geothermal Loan Guaranty Program will be performed. (MHR)

SOLAR ENERGY CONVERSION

PHOTOVOLTAIC CONVERSION

REFER ALSO TO CITATION(S) 7794, 7823, 7837

7669 (COO—4094-4) **25-kilowatt, photovoltaic-powdered, agricultural experiment at Mead, Nebraska.** Matlin, R.W.; Romaine, W.R.; Fischbach, P.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 21 Apr 1978. Contract EY-76-C-02-4094. 26p. Dep. NTIS, PC A03/MF A01.

In the United States, the first step toward the realization of large-scale agricultural systems utilizing photovoltaics was made during the summer of 1977 by the construction and operation of an experimental unit generating approximately 25-kW peak power. This experiment will test the application of solar energy to a variety of agricultural tasks, including irrigation and crop drying. During the past summer, this unit powered a 10-horsepower pump that was interconnected with an automatic gated-pipe irrigation network and a reservoir of two acre-feet capacity. It was designed to irrigate 80 acres of corn, 12 hours a day at the rate of 1000 gallons a minute. In early October, after the end of the irrigation season, the power was switched to nearby corn-drying bins where a forced-air drying technique is being tested utilizing photovoltaic-powered circulation fans. Two grain bins, each with a 5-horsepower fan, have been set up near the solar collector to dry the crop. Electricity generated by the solar unit is used to power the fan for in-bin drying of the grain.

7670 (DOE/JPL/954355—5) **Large area silicon sheet by EFG. Quarterly report No. 1, January 1, 1978—March 31, 1978.** Wald, F.V. (Mobil Tyco Solar Energy Corp., Waltham, MA (USA)). 15 Apr 1978. Contract NAS-7-100-954355. 70p. Dep. NTIS, PC A04/MF A01.

During this quarter, Phase I of the contract was concluded and Phase II initiated. Toward the end of Phase I, a full five ribbon multiple growth demonstration was achieved in JPL No. 3A. Work is now proceeding with rebuilding this furnace to attempt to meet the phase II goals of increased furnace reliability, throughput and material quality upgrading. The details of this work are presented. Development work with the 7.5 cm cartridge system in JPL No. 1 has proceeded toward the goal of 7.5 cm wide ribbon growth at 7.5 cm/min. Conditions required for full-width growth in the speed range of 4 to 5 cm/min have been identified and achieved with the use of redesigned die and heaters. A high degree of reliability of operation of the 7.5 cm cartridge system has allowed the study of die top thermal conditions and the start of "clean runs" to establish a baseline material quality level for the 7.5 cm cartridge system. This work is described in Section II. The initial activities associated with the building of a fully instrumented single 7.5 cm cartridge furnace (No. 17) are outlined. The mini cold shoe due to be used in this furnace has undergone successful growth tests in JPL No. 1. Studies of the gas distribution patterns and thermal interactions of the cold shoe with other growth system components are also discussed. Finally, characterization data for furnaces JPL No. 1 and JPL No. 3A are given. These represent the initial work aimed at establishing a baseline to aid further studies of material quality. Results for the first 7.5 cm by 7.5 cm solar cells made from ribbon grown in JPL No. 1 are also presented.

7671 (DOE/JPL/954356—6) **Silicon-on-ceramic coating process. Silicon sheet growth development for the Large-Area Silicon Sheet and Cell Development Tasks of the Low-Cost Silicon Solar Array Project. Quarterly report No. 9, March 29—June 30, 1978.** Chapman, P.W.; Zook, J.D.; Heaps, J.D.; Grung, B.L.; Koepke, B.; Sculdt, S.B. (Honeywell Corporate Material Sciences Center, Bloomington, MN (USA)). 21 Jul 1978. Contract NAS-7-100-954356. 77p. Dep. NTIS, PC A05/MF A01.

This research program began on 21 October 1975. Its purpose is to investigate technical and economic feasibility of producing solar-cell-quality sheet silicon by coating inexpensive ceramic substrates with a thin layer of polycrystalline silicon. The coating methods to be developed are directed toward minimum-cost process for producing solar cells with a terrestrial conversion efficiency of 12% or greater. By applying a graphite coating to one face of a ceramic substrate, molten silicon can be caused to wet only that graphite-coated face and produce uniform thin layers of large-grain polycrystalline silicon; thus, only a minimal quantity of silicon is consumed. A dip-coating method for putting silicon on ceramic (SOC) has been shown to produce solar-cell-quality sheet silicon. This method and a continuous coating process also being investigated have excellent scale-up potential which offers an outstanding cost-effective way to manufacture large-area solar cells. The dip-coating investigation has shown that, as the substrate is pulled from the molten silicon, crystallization continues to occur from previously grown silicon. Therefore, as the substrate length is increased (as would be the case in a scaled-up process), the expectancy for larger crystallites increases. A variety of ceramic materials have been dip-coated with silicon. The investigation has shown that mullite substrates containing an excess of SiO_2 best match the thermal expansion coefficient of silicon and hence produce the best SOC layers. With such substrates, smooth and uniform silicon layers 25 cm^2 in area have been achieved with single-crystal grains as large as 4 mm in width and several cm in length. Crystal length is limited by the length of the substrate. The thickness of the coating and the size of the crystalline grains are controlled by the temperature of the melt and the rate at which the substrate is withdrawn from the melt. Results and accomplishments during the quarter are presented.

7672 (DOE/JPL/954373—7) **Heat exchanger method, ingot casting; fixed abrasive method, multi-wire slicing. Phase II. Silicon sheet growth development for Large Area Sheet Task of the Low Cost Silicon solar Array Project. Quarterly progress report No. 3, April 1—June 30, 1978.** schmid, F.; Khattak, C.P. (Crystal Systems, Inc., Salem, MA (USA)). 15 Jul 1978. Contract NAS-7-100-954373. 56p. Dep. NTIS, PC A04/MF A01.

Semiconductor grade silica crucibles have been fabricated and used to produce crack-free ingots with almost total single crystallinity. Solar cells fabricated out of HEM cast material have shown conversion efficiencies of 14%. The high V/sub oc/ and CFF values suggests that this material is purified by the directional solidification. A very high degree of crystallinity has been achieved in the square ingots cast. High purity square crucibles are being fabricated. Efficient slicing was carried out with 30 μm and 22 μm diamonds in addition to the 45 μm size. The use of synthetic diamonds gave a poorer performance as compared to the natural kind. The surface damage with 22 μm diamonds was 4 to 6 μm. The nickel plating after impregnation holds the diamonds if it is suitably hardened by heat treatment. The projected add-on cost for 1982 and 1986 is $(20.27 to 34.89) and $10.62 per square meter of silicon wafer respectively using the HEM and FAM approaches.

7673 (DOE/JPL/954521—5) **Integral glass encapsulation for solar arrays. Quarterly progress report No. 6.** Younger, P.R.; Kreisman, W.S.; Kirkpatrick, A.R. (Spire Corp., Bedford, MA (USA)). Feb 1978. Contract NAS-7-100-954521. 31p. Dep. NTIS, PC A03/MF A01.

This is the sixth quarterly report under a program to develop integral glass encapsulation for solar cell arrays. The status of development to establish techniques for employing electrostatic bonding in conjunction with terrestrial solar cells is described.

7674 (DOE/JPL/954560—7) **Synthesis of silane and silicon in a non-equilibrium plasma jet. Seventh quarterly report, February 1—April 30, 1978.** Calcote, H.F.; Lewis, E.J.; Mullen, R.H. (Aerochem Research Labs., Inc., Princeton, NJ (USA)). Jul 1978. Contract NAS-7-100-954560. 25p. (AeroChem-TN—194). Dep. NTIS, PC A02/MF A01.

The objective is to determine the feasibility of using a non-equilibrium hydrogen plasma jet as a chemical synthesis tool. The program has been narrowed down to determining the feasibility of preparing amorphous silicon photovoltaic surfaces from the reaction of $SiCl_4$, $SiHCl_3$, or SiH_4 with a non-equilibrium H/H_2 jet. The annular mixing nozzle has been characterized and found to give good mixing, while maintaining the integrity of the jet. The H-atom yields and efficiencies are similar to those for other nozzles. Further consideration of the NO_2 titration of H atoms indicates that the mass spectrometer sampling probe could be used to determine the titration endpoint and could also be used to determine the extent of mixing of the H/H_2 jet and the other reactant. The main effort has been on the preparation of amorphous silicon films. In experiments with $SiCl_4$, $SiHCl_3$, and SiH_4 where a cooled substrate holder was placed normal to the reacting jet, only polymeric powdery films were produced. When the substrate was placed on the bottom of a tube restricting recirculation of products back into the reacting jet, strongly adhering amorphous films were prepared from $SiCl_4$ on Vycor, Pyrex, aluminum and carbon substrates. These films became polycrystalline on heating to 500°C for 24 hrs, by jet heating during long exposure times, or when high discharge power was used. The electrical resistivity of the films is between 1 to 20 x 10^8 ohm cm with activation energies for electrical conductivity between 0.5 and 1.0 eV. These values are in the range for undoped amorphous silicon films prepared by the glow discharge technique and demonstrated to accept dopants to become photovoltaic.

7675 (DOE/JPL/954654—4) **Silicon web process development. Low Cost Solar Array Project. Large Area Silicon Sheet Task. Quarterly report, April 20, 1978—June 30, 1978.** Duncan, C.S.; Seidensticker, R.G.; Hopkins, R.H.; McHugh, J.P.; Wehrli, H.A. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1978. Contract NAS-7-100-954654. 30p. Dep. NTIS, PC A03/MF A01.

The J and RE web growth facilities were modified during this period. The RE facility was converted to the elongated susceptor system which has produced web widths to 4.1 centimeters. The RE facility was also modified to accept a melt replenishment system when available. The J facility was modified to accept an adjustable afterheater system when it is available. Preliminary runs have been made with passive afterheaters in the J facility. Both the J and RE facilities were used for training additional operators. The W web growth facility was modified for use by engineering personnel and was placed in daily operation. Web was grown from the beginning, the greatest emphasis being placed on achieving routine reproducible operation. Thermal models of the growing web and analysis of the deformation have brought the conclusion that a non-linear vertical profile primarily in the elastic range of temperature in the web above the melt produces stress which in turn causes deformation of the web. To alleviate this condition two types of afterheaters have been designed. One of these is passive and is integral to the susceptor assembly. The other design includes electrical heaters which can be adjusted for temperature, temperature gradient and position while in actual web growth operation. Both types are now in development and fabrication. A manually operated melt replenishment system has been designed and is being fabricated.

7676 (DOE/JPL/954831—3) **High efficiency, long life terrestrial solar panel. Final report, September 1, 1977—March 31, 1978.** Khemthong, S.; Ling, K.; Olah, S.; Yoo, H. (Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.). 1978. Contract NAS-7-100-954831. 48p. Dep. NTIS, PC A03/MF A01.

Six high efficiency, long life terrestrial modules were designed, fabricated and delivered to JPL. The module utilized 256 large area, rectangular, high efficiency solar cells. A flexible, overlapping design to connect cells in series was used to maximize the packing density. The efficiency of the six modules delivered, based on the overall dimensions at 100 mW/cm^2 and 28°C is tabulated, and the contract goal of 13% array efficiency was achieved. The manufacturing sequence, performance curves, and cost analysis are discussed.

7677 (DOE/JPL/954868—2) **Automated array assembly, phase II. Quarterly report No. 2, January 1—March 31, 1978.** D'Aiello, R.V. (RCA Labs., Princeton, NJ (USA)). Mar 1978. Contract NAS-7-100-954868. 54p. Dep. NTIS, PC A04/MF A01.

Efforts were concentrated on studies of junction formation by ion implantation, metallization by silk screen printing, spray-on antireflection (AR) coating, and interconnections by welding and reflow solder. Ion-implantation studies have shown that the cell efficiency and open-circuit voltage increase with increasing ^{31}P up to 5 x 10^{15} ion dosage. The metallization studies have been concerned with the characterization of commercially obtained inks as well as the in-house synthesis of several inks. The spray-on AR coating studies have resulted in the definition of a series of process steps which yield an AR coating of satisfactory uniformity in thickness and reproducibility from run to run. It was concluded on the basis of present studies that welding is not a suitable assembly process for cells of current design and a solder reflow technique is being studied. As an alternate to the PVB lamination technique, casting methyl methacrylate-butyl acrylate resin between the glass plates is under consideration. The approach to solving this problem is described.

7678 (DOE/JPL/954882—10) **Process development for automated solar cell and module production. Task 4: automated array assembly. Quarterly report No. 2.** Witham, C.R. (MB Associates, San Ramon, CA (USA)). 14 Jul 1978. Contract NAS-7-100-954882. 49p. Dep. NTIS, PC A03/MF A01.

The objective of this program is to develop the process and handling technology required to allow large volume, low cost terrestrial solar array production. Process emphasis has been placed upon edge molding of finished panels, cell layup and interconnection into arrays, and aluminum back contact technology. These three technologies show promise for improved panel performance at lower production costs. Work has also involved critical technological and economic analysis of a proposed process sequence. Analyses indicate that this processing sequence will allow production at the price goals for 1986 in the areas of cell and panel manufacturing.

7679 (DOE/JPL/954898—2) **Phase 2, automated array assembly, Task IV Low-Cost Silicon Solar Array Project. Quarterly report No. 2, February 1—April 30, 1978.** (Lockheed Missiles and Space Co., Sunnyvale, CA (USA)). Apr 1978. Contract NAS-7-100-954898. 48p. (LMSC-D—628356). Dep. NTIS, PC A03/MF A01.

Areas of technical discussion center around process verifications and critical reviews of our selected process sequence. Processes being investigated include texture etching, ion implantation, laser annealing, screen printing, sprayed-on AR coatings, and module assembly. Three inch diameter 1 : 0: 0 Cz silicon wafers were processed through an NaOH texturizing solution supplied as a starting point. Several ion implantation runs were made on 3-inch diameter wafers using Extrion 20 to 200 (IR) and Acceleration, Inc., MP400 (LMSC) implanters. Laser annealing work was carried out using ruby, Nd : YAG, and frequency doubled Nd : YAG lasers. Scaling up laser annealing to accommodate the 3-inch diameter wafers, it was calculated that approximately a 70 joule capacity would be required. Screen printing of ohmic contacts was performed using DuPont 7095 and 4021 Ag and Ag/Al pastes, respectively. Additional spray-on material sources were obtained this period. Baseline functional cells were fabricated for reference use, which yielded approximately 9% Aml efficiency.

7680 (DOE/JPL/954977—1) **Quantitative analysis of defects in silicon. Silicon sheet growth development for the Large Area Silicon Sheet Task of the Low Cost Solar Array Project. Quarterly progress report No. 1.** Natesh, R. (Materials Research, Inc., Centerville, UT (USA)). Jun 1978. Contract NAS-7-100-954977. 13p. Dep. NTIS, PC A02/MF A01.

The objective of this program is to evaluate and, if possible, predict the conversion efficiency for a variety of silicon samples with differences in structural defects, such as grain boundaries, twin boundaries, precipitate particles, dislocations, etc. It is important to know the type of defect/defects, and the concentration at which such defect/defects severely cause deterioration of conversion efficiency. Quantitative data of this nature may then enable us to predict the performance of silicon samples before they are fabricated into solar cells. Also, such a technique may, in addition, be used routinely as a Nondestructive Quality Assurance Tool to rapidly and routinely evaluate and survey a variety of silicon samples with differences in growth, fabrication, and processing variables. Quantitative analysis of surface defects will be performed by using a Quantimet 720 Quantitative Microscopy System. This system can differentiate and count 67 shades of gray levels between black and white contrasts. In addition, it can characterize defects (such as dislocations, twin boundaries, precipitates, grain boundaries, etc.) by measuring their length, perimeter, area, density, spatial distribution, frequency distribution (in any preselected direction), and so on. However, the Quantitative Microscopy System is extremely sensitive to optical contrasts of various defects. Therefore, to obtain reproducible results, the contrasts produced by various defects must be similar and uniform for each defect type along the entire surface area of samples to be analyzed. To achieve this, a chemical cleaning and polishing technique has now been perfected; and this technique is now routine-

ly used. The cleaning and polishing preparation technique is described.

7681 (SAND—78-0685) **Palladium passivated titanium—silver conductor patterns for high illumination intensity silicon solar cells.** Sharp, D.J. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 25p. Dep. NTIS, PC A02/MF A01.

This study reports the use of a palladium thin film intermediary as a corrosion inhibiting layer for the titanium-silver conductor patterns used in the Sandia Laboratories silicon solar cell effort. Vacuum deposited films are generally porous and admit moisture and other corrosion promoting contaminants to the more chemically active underlying adhesive layers. Furthermore, thin capillary pores in film structures induce moisture adsorption approaching that of liquid water. The use of palladium generates a significantly higher anodic potential at corrosion sites and it is postulated that the subsequent thicker titanium oxide layer inhibits corrosion and passivates the film composite. Accelerated corrosion data, long-term field evaluation, and potentiometric measurements showing the effect of palladium on the corrosion of titanium-silver film structures are discussed.

7682 (TID—28572) **Improved semiconductors for photovoltaic solar cells: $CuInSe_2$. Final progress report, June 18, 1976—July 18, 1977.** Buldhaupt, L.F.; Mickelsen, R.A.; Chen, W.S. (Boeing Aerospace Co., Seattle, WA (USA)). 1977. Contract EX-76-C-01-2459. 46p. Dep. NTIS, PC A03/MF A01.

The objective of this research program was the investigation of copper indium selenide ($CuInSe_2$) films as a promising potential semiconductor material for low cost, mass produced thin film photovoltaic solar cells. Major activities during the program have been the development of a semiconductor film formation process, characterization of the deposited films, and analysis of factors relating to future high volume production concepts for the CdS/$CuInSe_2$ thin film cell. The developed $CuInSe_2$ film formation method, which was based upon simultaneous elemental evaporation from three vapor sources, is described along with the influence of deposition parameters on film properties and the conditions necessary to achieve single phase films. Structural, electrical, and optical properties of the deposited films and their relationship to the deposition parameters are reported. The achievement of single phase chalcopyrite structure films with grain sizes of 0.5 to 1.5 microns is described. Although adjustable over a wide range, single phase films are shown to possess other important properties such as: resistivity—100 ohm-cm; hole mobility—5.6 cm^2/V-sec; hole concentration—1.1 x 10^{16} cm^{-3}; band gap energy—1.04 eV; index of refraction—3.05; and estimated absorption coefficient at one micron wavelengths—3 x 10^4 cm^{-1}. A decrease in hole mobility and resistivity with high humidity is reported. A high volume production cost estimate for the thin film CdS/$CuInSe_2$ cell is presented indicating costs of $40/KW. Finally, factors which must be considered in the future cell production and development are described as well as the projected cell performance derived from a theoretical analysis.

BIOMASS PRODUCTION AND CONVERSION

REFER ALSO TO CITATION(S) 7595, 7596, 7601, 7606, 7636, 7637, 7638, 7639, 7640, 7641, 7642, 7645, 7648, 8436, 8437

7683 (COO—4198-6) **Degradation of cellulosic biomass and its subsequent utilization for the production of chemical feedstocks. Progress report, March 1—May 31, 1978.** Wang, D.I.C.; Cooney, C.L.; Demain, A.L.; Gomez, R.F.; Sinskey, A.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nutrition and Food Science). May 1978. Contract EG-77-S-02-4198. 212p. Dep. NTIS, PC A10/MF A01.

Studies on the xylanase activity of Clostridium thermocellum and other thermophilic anaerobes were continued. It was shown that the xylanase and CMCase activities of C. thermocellum during fermentation are nearly identical. The enzyme complex from C. thermocellum continues to show resistance to feedback inhibition in every assay system tested. No inhibitory effect on Avicel hydrolysis by 50 mg/l of glucose, cellobiose, or xylose was observed. In experiments on thermally exploded poplar, corn cob granules, corn stover, and sugar cane bagasse, C. thermocellum was found to be capable of degrading all of these materials, but the amount of reducing sugars accumulated was found inversely related to particle size. To increase biomass surface area, as well as biomass concentrations, a packed-bed cellulose fermentor was constructed and tested. Research on the production of ethanol directly from cellulosic biomass by C. thermocellum continued. A method for generating protoplasts from growing cultures of C. thermocellum was developed. Acrylic acid production by Clostridium propionicum was further studied in order to optimize the oxidation of propionic and to acrylic acid. Studies conducted on the aerobic oxidation of lactic acid and propionic acid to acrylic acid by resting cells and cell-free extracts prepared from Escherichia coli were unsuccessful. Production of lactic acid was investigated by employing mixed cultures of Clostridium thermocellum and a thermophilic lactic acid producing bacterium. Studies on the acetone-butanol fermentation focused on means of increasing butanol tolerance by Clostridium acetobutylicum. Acetic acid production by Clostridium thermoaceticum continued to isolate product tolerant strains. (JGB)

7684 (COO—4225-1) **Fuels from biomass symposium.** Pfeffer, J.T.; Stukel, J.J. (eds.). (Illinois Univ., Urbana (USA). Office of Energy Research). 1977. Contract EG-77-C-02-4225. 220p. (CONF-770481—). Dep. NTIS, PC A10/MF A01.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

The thirteen papers presented are compiled. Each was individually prepared for inclusion into the EDB data base. (JSR)

7685 (COO—4225-1, pp 13-28) **Biomass potential from agricultural production.** Benson, W. (Midwest Research Inst., Kansas City, MO). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

Estimates of the potential quantity of biomass from agricultural production of grain and grass crops have been developed from the analysis of a specially constructed data base. The results are presented and discussed. (JSR)

7686 (COO—4225-1, pp 29-36) **Silvicultural energy farms.** Inman, R.E.; Salo, D.J. (MITRE Corp., McLean, VA). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The results of a systems analysis of the concept of silvaculture energy farms are summarized. These include deterrents to the concept, farm design, and production costs. Needed research is briefly indicated. (JSR)

7687 (COO—4225-1, pp 37-41) **Biomass production: what land is available.** Cotner, M. (Dept. of Agriculture, Washington, DC). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The likelihood that biomass producers could successfully compete for the available land is discussed from the following viewpoints: present land use in the US; assessment of emerging agricultural demand for land; production capacity, and relationship between agricultural and biomass production. Policy implication of biomass production are briefly considered. (JSR)

7688 (COO—4225-1, pp 43-58) **Photosynthesis Energy Factory: analysis, synthesis, and demonstration.** Szego, G.C.; Fraser, M.; Harmer, C.H.; Henry, J.F.; Scholten, W.B.; Vail, C.W. (InterTechnology/Solar Corp., Warrenton, VA). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The photosynthesis Energy Factory is a synergistic combination of the dry land Energy Plantation/sup TM/ and an algae production system which can produce on a perpetually renewable basis unpolluting and totally domestic fuels from solar energy and various residues. From the Energy Plantation/sup TM/, woody plant matter is produced which is chipped and used as a solid fuel in a power plant to produce electricity. The algae production system uses the nutrients in wastewaster and the CO_2 in power plant flue gas to produce algae, which are harvested and ultimately digested anaerobically to produce methane. Digester sludge is disposed of in a beneficial way by being put onto the Energy Plantation/sup TM/. Work is currently being done to study this concept to investigate its characteristics and apparent benefits. A comprehensive techno-economic model is being developed for a systems analysis. Potential sites for a demonstration project are being analyzed and selected. The final task in this project is to develop a preliminary design and associated cost estimates for a proposed demonstration.

7689 (COO—4225-1, pp 59-81) **Production of biomass from fresh water aquatic systems: concepts of large-scale bioconversion systems using microalgae.** Oswald, W.J.; Benemann, J.R.; Koopman, B.L. (Univ. of California, Berkeley). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

At present the largest operating solar energy conversion systems are sewage-treatment ponds utilizing microalgae for oxygen production. If economical methods of microalgal cultivation and harvesting can be developed, such systems could produce biomass suitable for conversion to methane and fertilizer. Microalgal waste treatment-bioconversion systems could be expanded to provide ad-

vanced or complete liquid waste treatment as well as a significant fraction of local energy requirements. Systems for agricultural fertilizer and energy production are possible using nitrogen-fixing blue-green algae. Large-scale centralized systems designed for substitute natural gas production might be developed by recycling of nutrients termed "nutrient integration".

7690 (COO—4225-1, pp 83-98) **Cultivation of seaweeds as a biomass source for energy.** Ryther, J.H.; Lapointe, B.E.; Stenberg, R.W.; Williams, L.D. (Woods Hole Oceanographic, MA). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

The present state of the art of seaweed culture is briefly reviewed. Few quantitative measurements of growth or yield have been made or documented. Recent studies in the culture of Gracilaria folifera, a red algae, are discussed in more detail. (JSR)

7691 (COO—4225-1, pp 99-114) **Oceanic setting as a site for biomass production.** North, W.J. (California Inst. of Tech., Pasadena). 1977.

From Fuels from biomass symposium; Champaign, IL, USA (18 Apr 1977).

In Fuels from biomass symposium.

Recent studies on the growth of the giant kelp Macrocystis are summarized with emphasis on the research on nutritional needs. The growth in surface water and in water pumped up from the deeps is compared. (JSR)

7692 **Logistics of energy resources and residues.** Miles, T.R. pp 225-248 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

An attempt is made to put into practical perspective the various operational and economic factors and restraints of collection, storage, and transport that often dictate the feasibility of using renewable resources and residues as reliable energy sources. Other residue materials in addition to biomass are included.

PHOTOCHEMICAL AND THERMOCHEMICAL CONVERSION

REFER ALSO TO CITATION(S) 7551, 7561, 7574, 7879

SOLAR THERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 7877

7693 (CONF-770953—, pp 4.25-4.32) **Sun-tracking control of solar collectors using high-performance step motors.** Hughes, R.O. (Jet Propulsion Lab., Pasadena, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A survey of solar energy concentration concepts is given. Several power plant candidates are considered including the central receiver, thermionic conversion, and distributed solar thermal collector. The Perkins solar thermal collector configuration represents a design that could significantly reduce initial capital expenditures by using a close-to-the-ground approach. This collector could be used as a stand-alone mode of operation for remote area applications. Additionally, this design could easily be modified for a heliostat operation mode. Stepper motors as prime movers for solar collectors/heliostats appear to have a promising future because of their wide dynamic range, relatively low cost, and easy interface with digital electronics. High-performance stepper motors with high power output are currently being manufactured by several companies. Performance criteria for solar thermal collectors should be carefully considered since cost is directly related to desired performance. The traditional pointing accuracy approach of specification could lead to unnecessary design features while a criterion that uses heat transfer characteristics could significantly reduce initial costs.

7694 (CONF-770953—, pp 5.63-5.74) **Design and the testing of a solar receiver for a Stirling engine.** Wu, Y.C.; Moynihan, P.I.; Day, F.D.; Selcuk, M.K. (Jet Propulsion Lab., Pasadena, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A highly efficient solar receiver is a key component of a solar electric power generation system that uses a sun tracking paraboloidal collector, a solar receiver, and a Stirling engine-linear alternator combination. As one part of the efforts in the development of such a system, a solar Stirling receiver experiment program was undertaken, and the results are reported. The design, the testing, and the test results of an experimental receiver, suggestions of advanced receiver design concepts, and considerations of the integration of the receiver with the Stirling engine are presented. This experimental receiver was adapted to a 2.90 m (9.5 ft) nickel vapor-deposited paraboloidal solar collector located at the Caltech JPL Table Mountain Solar Test Facility. The receiver is a cavity composed of four essential parts: a heat exchanger section, a properly contoured ceramic receiver body, an aperture piece, and an insulation canister. The test results indicate that such an experimental receiver can achieve an efficiency of close to 90% with possible improvements by minor design modifications and is thus a feasible receiver concept for the type of application under consideration. For field operation, however, it requires the incorporation of some heat storage capability.

CENTRAL RECEIVER

REFER ALSO TO CITATION(S) 7781

7695 (SAN—1110-77-2(Vol.6)(App.C-H)) **Central receiver solar thermal power system, phase I: preliminary design report. Volume VI. Electrical power generation/master control subsystems and balance of plant. Appendixes C-H.** (Martin Marietta Corp., Denver, CO (USA)). Apr 1977. Contract EY-77-C-03-1110. 116p. Dep. NTIS, PC A06/MF A01.

The appendices include the following: seventy-eight engineering drawings for the central receiver solar thermal power system; site topography and geological maps; the design bases related to the electrical power generation subsystem (EPGS) and balance of plant (BOP); mechanical and electrical equipment list for EPGS and BOP; other engineering effort; glossary of terms; and references. (MHR)

DISTRIBUTED COLLECTOR

REFER ALSO TO CITATION(S) 7814

7696 (CONF-770953—, pp 4.1-4.12) **Modular electrical generation using parabolic dish solar concentrators.** Peterson, R.C.; Evans, R.A. (Honeywell Inc., Minneapolis). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The preliminary design of a modular electric power generation system utilizing parabolic dish-shaped solar concentrators is presented. Solar thermal-to-electric power conversion is accomplished at the module level by use of a recuperated open Brayton cycle gas turbine heat engine, which drives a 16 kWe generator. A two-axis tracking circular paraboloid-of-revolution dish-shaped concentrator 48 feet in diameter collects the solar insolation and redirects it toward the focal point. A high temperature, cavity-type thermal receiver/heat exchanger is positioned with its aperture centered at this focal point. All major power system components are mounted on top of the receiver structure. Based upon Albuquerque, N.M., 1962 insolation and weather data, the system will operate in excess of 3200 hours per year and will generate 49.1 MWh (net) of electric energy per year per module. An alternate system is also discussed that will operate in excess of 2900 hours per year and will generate 70 MWh (net) of electric energy per year per module. Extensive ongoing developmental work in high efficiency heat engines offers excellent growth potential for this modular electrical generation system, resulting in decreased busbar energy costs.

7697 (CONF-770953—, pp 8.47-8.53) **1 KW solar pump system.** Almanza, R.; Diaz, A.; Gonzalez, A.; Lopez, S. (National Univ. of Mexico, Mexico City). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

One of the objectives of a group formed in 1975 at the Institute of Engineering, deals with the development of photothermal-mechanical processes in regard to power systems. The first stage is a 1 KW system consisting of the following parts: (a) 30 m^2 parabolic cylinder collectors covered with different kinds of reflective materials. The focus of the parabola is located at 50 cm having a rim angle of 90°; (b) an absorber at the focal position made of copper pipe covered with a CuO and Cu_2O mixture as the selective surface, in order to minimize the radiation losses; (c) the absorber is located inside a 10^{-2} torr evacuated pyrex glass pipe, in order to reduce the convective losses; (d) a steam piston engine was chosen as the mechanical system with about 50% efficiency. Also a 1 KW steam turbine was tried, unfortunately with a very low efficiency (about 5%). The working fluid has been steam at 170°C at 3 to 5 atms pressure. This system has been connected to a pump in a shallow-water well.

TOTAL ENERGY AND HYBRID SYSTEMS

REFER ALSO TO CITATION(S) 7825

7698 (SAND—78-0919C) **Preliminary design of the Solar Total Energy-Large Scale Experiment at Shenandoah, Georgia.** Poche, A.J.; Haas, S.A.; Hunke, R.W. (Sandia Labs., Albuquerque, NM (USA)). [nd]. Contract EY-76-C-04-0789. 25p. (CONF-780801—26). Dep. NTIS, PC A02/MF A01.

From 13. intersociety energy conversion engineering conference; San Diego, CA, USA (20 Aug 1978).

A preliminary design study is described for the Solar Total Energy System (STES) for the U.S. Department of Energy's Large Scale Experiment at Shenandoah, Georgia. The STES will supply electric power, process steam, and hot water for heating and (absorption) air conditioning demands of a 42,000 square foot building owned by Shenandoah Development, Inc., and operated by Bleyle America, Inc., a knitwear manufacturer. Georgia Power Company, participating via Cooperative Agreement with DOE, is responsible for providing the Shenandoah site for the Large Scale Experiment. In addition to the preliminary design of the STES, the study includes experiment site layout, definition of site-specific system requirements, and development of preliminary plans for the operating phase.

OCEAN THERMAL GRADIENT POWER PLANTS

7699 (COO—4041-6) **Design report for PS-105 data acquisition system for biofouling studies of heat exchangers in seawater.** Findley, R.W.; Meier, D.L. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). 1 Sep 1977. Contract EY-76-S-02-4041. 54p. Dep. NTIS, PC A04/MF A01.

An electronic system that is well-suited for acquiring OTEC heat exchanger fouling data from surface installations has been designed, constructed, laboratory-tested and field-proven. The CMU device for monitoring the degradation of heat transfer rates due to fouling is equipped with electrical transducers for measuring seawater temperature, flow velocity and heat transfer coefficient. The function of the electronics system described herein is to power the transducers, to boost the low-level output signals from the transducers and to transmit these amplified signals to a central control box where this raw data is sampled at precisely-defined intervals and transferred to a computer-compatible medium. In its present form the system can accommodate two CMU devices, but more could be added by external multiplexing. This system has performed well in acquiring fouling data from Caribbean waters near St. Croix.

SOLAR RADIATION UTILIZATION

SPACE HEATING AND COOLING

REFER ALSO TO CITATION(S) 7782, 7822, 7854

7700 (CONF-770487—, pp 71-76) **Measurement of system performance in the BRE solar house.** Wozniak, S.J. (Building Research Establishment, Garston, Eng.). 1977.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

In Testing of solar collectors and systems.

As part of an expanding program of research on energy conservation in buildings, three experimental low energy houses are being built at the BRE Garston site. A brief description is given of the energy handling system in the "solar" house, and an outline of the computerized instrumentation designed to monitor the performance of all three houses is presented.

7701 (CONF-770487—, pp 77-82) **Testing of solar collectors and systems in development and production.** Sharpley, D.E. (Don Engineering (South West) Ltd., Wellington, Somerset, Eng.). 1977.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

In Testing of solar collectors and systems.

A commercial testing program to develop collectors and systems and produce needed factual results is reviewed. Components of special concern are the collector, the indirect hot water cylinder, and the temperature differential control. Test facilities and conditions are described. (MHR)

7702 (CONF-770953—, pp 5.75-5.104) **Hydride heat pump system for building air conditioning using high temperature solar input.** Gorman, R.; Akridge, W.L. 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

This paper presents the results of a performance and cost analysis of a metal hydride air conditioning (heat pump) system as compared to conventional absorption heat pumps and a projection of the capabilities and uses of the system for power generation. This system concept was developed by D.M. Gruen, et al., Argonne National Laboratory. Due to the preliminary state of development of the Hydride Conversion and Storage Systems (HYSCOS) concept, a major part of the effort was to develop a baseline design for a commercially-practical hydride air-conditioner driven by solar energy obtained by concentrating collectors. A 100-ton design capacity was arbitrarily chosen to coincide with the size of commercially available Lithium Bromide absorption heat pumps. The resultant 100-ton baseline system was estimated to have a coefficient-of-performance (COP) of 0.46 at a total cost of $17,292. In the baseline systems, the cost of the hydride represents 51% of the total cost. The above estimates may be compared to a 100-ton Lithium Bromide absorption heat pump which exhibits a COP of a 0.68 and is commercially priced at $20,000.

7703 (CONF-770953—, pp 8.21-8.28) **Honeywell general offices solar system.** Waters, D.E.; Block, R.F. (Honeywell Inc., Minneapolis). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A description of an advanced solar energy HVAC system presently under construction by Honeywell Inc. is presented. The solar system will provide 82% of the cooling energy, 53% of the heating energy, and 100% of the domestic hot water energy for a 100,000 ft^2 office building in Minneapolis, Minnesota. The solar system components are described, including the parabolic trough collectors, the heating and cooling subsystems and the solar system controls. The technical rationale for the selection of the collector, the Rankine cycle turbine, the heat transfer fluids and the thermal storage system is discussed. Annual and peak load system performance predictions are also presented.

7704 (DOE/CS—0008) **National program plan for research and development in solar heating and cooling for building, agricultural, and industrial applications.** (Department of Energy, Washington, DC (USA)). Aug 1978. 232p. Dep. NTIS, PC A11/MF A01.

The main feature of the directed program is the focus on specific approaches, called paths, to the application of solar energy. A path is the linking of a method of energy collection or rejection with a particular application. Eleven such paths are identified for building applications and eleven for agricultural and industrial process applications. Here, an overview is given of the program plan. The 11 paths to the solar heating and cooling of buildings and the 11 paths for agricultural and industrial process applications are described. Brief descriptions of these tasks and of the non-engineering tasks are included. The importance of each non-engineering task to the overall R and D program is indicated. (MHR)

7705 (DOE/NASA/CR—78172) **Hardware problems encountered in solar heating and cooling systems.** Cash, M. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). May 1978. Contract EX-76-A-29-1037. 39p. Dep. NTIS, PC A03/MF A01.

Marshall Space Flight Center personnel have worked for several years with the development and demonstration of solar heating and cooling systems in support of the Department of Energy. In this work, they have encountered numerous problems in the design, production, installation, and operation of the solar energy systems. Many of these problems have been seen in more than one system. The hardware problems, which range from simple to obscure and complex, and their resolution are described. It is intended to provide personnel in the solar energy field with information that will help prevent the installation of solar heating and cooling systems that will not operate satisfactorily or that will not last for the design lifetime.

7706 (DOE/NASA/CR—150496) **Comparison of solar system measured data for various sample rates.** Chiou, J. Sr. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Nov 1977. Contract EX-76-A-29-1037. 31p. Dep. NTIS, PC A03/MF A01.

Portions of document are illegible.

This study compared the results of MSFC Solar House data for sample rates of 50, 100, 250, 300, and 600 seconds. The data considered for summer days were the heat incident on the collectors, the heat collected by the collectors, the heat used by the air conditioner generator, and the heat used by the auxiliary heater. For winter days, the heat incident, the heat collected and the heat used by the heat exchanger were computed. These data were compared for different weather days such as clear days, partly cloudy days, cloudy days, and very cloudy days. Also, data for the integration of all these weather days were compared. The percentage differences

for these data, using 50 second sample rate as a base, are also presented.

7707 (DOE/NASA/CR—150522) **SIMS Prototype System I test results: engineering analysis.** (IBM Federal Systems Div., Huntsville, AL (USA)). 19 Jan 1978. Contract EX-76-A-29-1037. 72p. Dep. NTIS, PC A04/MF A01.

The space and domestic water solar heating system designated SIMS Prototype System 1 has been evaluated at the MSFC Solar Heating and Cooling Test Facility. The test system used 720 ft^2 (gross) of Solar Energy Products Air Collectors, a Solar Control Corporation SAM 20 Air Handler with Model 75-175 control unit, a Jackson Solar Storage tank with Rho Sigma Mod 106 controller, and 20 tons of rock storage. The test data analysis performed by IBM evaluates the system performance and documents the suitability of SIMS Prototype System 1 hardware for field installation.

7708 (DOE/NASA/CR—150524) **Installation package: SIMS prototype system 1A.** (IBM Federal Systems Div., Huntsville, AL (USA)). Dec 1976. Contract EX-76-A-29-1037. 86p. Dep. NTIS, MF A01.

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This package consists of details for the installation, operation and maintenance of a prototype heating and hot water system, designed for residential or light commercial applications. International Business Machines developed this system consisting of the following subsystems: air type collectors, pebble bed thermal storage, air handling unit, air to water heat exchanger, hot water preheat tank, auxiliary energy, and ducting system. This system is installed at Home Builders Association in Huntsville, Alabama (OTS-04).

7709 (DOE/NASA/CR—150532) **Application of solar energy to air conditioning systems.** Nash, J.M.; Harstad, A.J. (IBM Federal Systems Div., Huntsville, AL (USA)). Nov 1976. Contract EX-76-A-29-1037. 80p. Dep. NTIS, PC A05/MF A01.

The results of a survey of solar energy system applications of air conditioning are summarized. Techniques discussed are both solar powered (absorption cycle and the heat engine/Rankine cycle) and solar related (heat pump). Brief descriptions of the physical implications of various air conditioning techniques, discussions of status, proposed technological improvements, methods of utilization and simulation models are presented, along with an extensive bibliography of related literature.

7710 (DOE/NASA/CR—150533) **Site dependent factors affecting the economic feasibility of solar powered absorption cooling.** Bartlett, J.C. (IBM Federal Systems Div., Huntsville, AL (USA)). Jan 1978. Contract EX-76-A-29-1037. 37p. Dep. NTIS, PC A03/MF A01.

A procedure has been developed to evaluate the cost effectiveness of combining an absorption cycle chiller with a solar energy system. A basic assumption of the procedure is that a solar energy system exists for meeting the heating load of the building, and that the building must be cooled. The decision to be made is to either cool the building with a conventional vapor compression cycle chiller or to use the existing solar energy system to provide a heat input to the absorption chiller. Two methods of meeting the cooling load not supplied by solar energy were considered. In the first method, heat is supplied to the absorption chiller by a boiler using fossil fuel. In the second method, the load not met by solar energy is met by a conventional vapor compression chiller. In addition, the procedure can consider waste heat as another form of auxiliary energy. Commercial applications of solar cooling with an absorption chiller were found to be more cost effective than the residential applications. In general, it was found that the larger the chiller, the more economically feasible it would be. Also, it was found that a conventional vapor compression chiller is a viable alternative for the auxiliary cooling source, especially for the larger chillers. The results of the analysis gives a relative rating of the sites considered as to their economic feasibility of solar cooling. Before a final judgment is made on the cost effectiveness of a particular site, the influence of all parameters must be determined.

7711 (DOE/NASA/CR—150535) **System design and installation for RS600 programmable control system for solar heating and cooling.** (Rho Sigma, Inc., North Hollywood, CA (USA)). Jan 1978. Contract EX-76-A-29-1037. 169p. Dep. NTIS, PC A08/MF A01.

The installation, operation and maintenance manual, the system design drawings, installation drawings and the system design data brochure are presented. It provides detailed information necessary for the building/purchase and installation of the RS600 Programmable Control System for solar heating, combined heating and cooling and/or hot water systems. Included are such items as general specifications, user configuration and options, displays, theory of operation, trouble-shooting procedures, parts lists, drawings, diagrams, wiring lists and warranty and assistance.

7712 (DOE/NASA/CR—150537) **Site selection for MSFC operational tests of solar heating and cooling systems.** (IBM Federal Systems Div., Huntsville, AL (USA)). 10 Feb 1978. Contract EX-76-A-29-1037. 47p. Dep. NTIS, PC A03/MF A01.

Site selection guidelines for the sixty Marshall Space Flight Center operational test sites are presented considering hot water, space heating/hot water, and space heating/cooling/hot water systems. Included are site selection criteria, methodology, and sequence.

7713 (DOE/NASA/CR—150559) **Site selection feasibility for a solar energy system on the Fairbanks Federal Building.** (IBM Federal Systems Div., Huntsville, AL (USA)). 22 Feb 1978. Contract EY-76-A-29-1037. 44p. Dep. NTIS, PC A03/MF A01.

A feasibility study has been performed for the installation of a solar energy system on the Federal Building in Fairbanks, Alaska, a multi-floor office building with an enclosed parking garage. The study consisted of determining the collectable solar energy at the Fairbanks site on a monthly basis and comparing this to the monthly building heating load. Potential conventional fuel savings were calculated on a monthly basis and the overall economics of the solar system applications were considered. Possible solar system design considerations, collector and other system installation details, interface of the solar system with the conventional HVAC systems, and possible control modes were all addressed. Conclusions, recommendations and study details are presented.

7714 (DOE/NASA/CR—150570) **Prototype solar heating and cooling systems.** (AiResearch Mfg. Co., Torrance, CA (USA)). Mar 1978. Contract EX-76-A-29-1037. 251p. Dep. NTIS, MF A01.

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A collection of quarterly reports from the AiResearch Manufacturing Company covering the period July 12, 1976, through December 31, 1977, is presented. AiResearch Manufacturing Company is developing eight prototype solar heating and cooling systems. This effort calls for the development, manufacture, test, system installation, maintenance, problem resolution, and performance evaluation. The systems are 3, 25 and 75-ton size units.

7715 (DOE/NASA/CR—150571) **Schedules, technical status, and program activities in the development of a single family solar space heating system.** (Contemporary Systems, Inc., Jeffrey, NH (USA)). Mar 1978. Contract EX-76-A-29-1037. 21p. Dep. NTIS, PC A02/MF A01.

This document is a collection of three quarterly reports from Contemporary Systems, Inc., covering the period from November 1, 1976 through October 13, 1977. Contemporary Systems are developing two prototype solar heating systems consisting of the following subsystems: collector, storage, control, transport, and site data acquisition.

7716 (DOE/NASA/CR—150575) **Prototype solar heating and hot water system (a collection of quarterly reports).** (Wormser Scientific Corp., Stamford, CT (USA)). Oct 1977. Contract EX-76-A-29-1037. 25p. Dep. NTIS, PC A02/MF A01.

Three quarterly reports are given that cover the progress made in the development of a solar heating and hot water system. These quarterly reports discuss the development work and improvements to components and subsystems. The system uses the pyramidal optics solar concentrator for heating, and consists of the following subsystems: collector, control, transport, and site data acquisition. The system is installed at Columbia, South Carolina.

7717 (DOE/NASA/CR—150578) **Subsystem design package for the on-site monitor at solar heating and cooling sites.** (IBM Federal Systems Div., Huntsville, AL (USA)). Nov 1977. Contract EX-76-A-29-1037. 23p. Dep. NTIS, PC A02/MF A01.

This design package, consisting of the Performance Specification, Performance Requirements Cross Reference, and the Acceptance Test Procedure, reflects the material submitted to develop, design and build on-site monitors. The on-site monitor is a portable device which can be easily connected to a Site Data Acquisition Subsystem to allow readouts of realtime sensor data in voltage or engineering units at instrumented solar heating and cooling sites.

7718 (DOE/NASA/CR—150588) **Subsystem design package for Mod II site data acquisition system, solar heating and cooling.** (IBM Federal Systems Div., Huntsville, AL (USA)). Sep 1977. Contract EX-76-A-29-1037. 33p. Dep. NTIS, PC A03/MF A01.

This design package, consisting of the Performance Specification and the Acceptance Test Procedure, covers the Mod II Site Data Acquisition Subsystem being built for NASA/MSFC. The Mod II Site Data Acquisition Subsystem (SDAS) is designed to collect data from sensors located on residential or commercial buildings using a solar heating and/or cooling system.

7719 (DOE/NASA/CR—150589) **Quarterly and monthly reports for solar heating and cooling system.** (Solar Engineering and

Equipment Co., Metairie, LA (USA)). Oct 1977. Contract EX-76-A-29-1037. 31p. Dep. NTIS, PC A03/MF A01.

This document is a collection of six monthly reports and one quarterly report from Solar Engineering and Equipment Company (SEECO), covering the progress of work from September 30, 1976, through September 30, 1977. SEECO is developing two prototype solar heating systems consisting of the following subsystems: collector, control, and storage.

7720 (DOE/NASA/CR—150590) **Design review package for the on-site monitor for solar heating and cooling systems.** (IBM Federal Systems Div., Huntsville, AL (USA)). Jan 1977. Contract EX-76-A-29-1037. 12p. Dep. NTIS, PC A02/MF A01.

This design review package consists of the Performance Specification and Verification Matrix for the On-Site Monitor (OSM). The OSM is a portable device which, when connected to the Site Data Acquisition subsystem, allows readout of data on solar heating and cooling operational test sites.

7721 (DOE/NASA/CR—150600) **Design data brochure for CSI series V solar heating system.** (Contemporary Systems, Inc., Jeffrey, NH (USA)). Jan 1978. Contract EX-76-A-29-1037. 29p. Dep. NTIS, MF A01.

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The Design Data Brochure for Contemporary Systems, Inc. (CSI) is included, along with general information on system configuration, system sizing and mechanical layout. CSI is developing two single family prototype solar heating systems consisting of the following subsystems: collector, storage, control, transport, and government-furnished site data acquisition. The systems are being installed at York, PA, and Manchester, NH.

7722 (DOE/NASA/CR—150614) **System design package for IBM system one solar heating and domestic hot water.** (IBM Federal Systems Div., Huntsville, AL (USA)). Feb 1977. Contract EX-76-A-29-1037. 177p. Dep. NTIS, MF A01.

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This report is a collation of documents and drawings that describe a prototype solar heating and hot water system using air as the collector fluid and a pebble bed for heat storage. The system was designed for installation into a single-family dwelling. The description, performance specification, subsystem drawings, verification plan/procedure, and hazard analysis of the system are packaged for evaluation of the system with information sufficient to assemble a similar system. The first system (1A) solar heating and domestic hot water is in operation at the Home Builders Association, 2809 Burks Road, SW, Huntsville, Alabama. The second system (1B) is being installed at the U.S. Department of Interior, National Park Service, Carlsbad Caverns, New Mexico, Residence "L."

7723 (DOE/NASA/CR—150615) **Preliminary design package for prototype solar heating system.** (Contemporary Systems, Inc., Jeffrey, NH (USA)). 23 Nov 1976. Contract EX-76-A-29-1037. 56p. Dep. NTIS, PC A04/MF A01.

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This report is a collation of documents that were submitted by Contemporary Systems, Inc., for the preliminary design review on the development of a prototype solar heating system for single-family dwellings. Included are the Proposed Instrumentation Plan, Deviation Requirement, System Changes and Rationale, Preliminary Design Drawings, and other information pertaining to the progress and design of the system. This space heating system consists of the following subsystems: collector, storage, transport, control, and government-furnished site data acquisition. The two prototype systems will be installed at York, Pennsylvania, and Manchester, New Hampshire.

7724 (DOE/NASA/CR—150691) **Prototype solar heating and combined heating and cooling systems (quarterly report No.3).** (General Electric Co., Philadelphia, PA (USA). Space Div.). 1 Apr 1977. Contract EX-76-A-29-1037. 189p. Dep. NTIS, PC A09/MF A01.

The General Electric Company is developing eight prototype solar heating and combined heating and cooling systems. This effort includes development, manufacture, test, installation, maintenance, problem resolution, and performance evaluation.

7725 (DOE/NASA/CR—150692) **Prototype solar heating and combined heating and cooling systems. Quarterly report No. 4.** (General Electric Co., Philadelphia, PA (USA). Space Div.). 1 Jul 1977. Contract EX-76-A-29-1037. 76p. Dep. NTIS, PC A05/MF A01.

The General Electric Company is developing eight prototype solar heating and combined heating and cooling systems. This effort includes development, manufacture, test, installation, maintenance, problem resolution, and performance evaluation.

7726 (DOE/NASA/CR—150705) **Solar heating and cooling system design and development (quarterly summary).** (General Electric Co., Philadelphia, PA (USA). Space Div.). Apr 1978. Contract EX-76-A-29-1037. 33p. Dep. NTIS, PC A03/MF A01.

The General Electric Company is developing eight prototype solar heating and combined heating and cooling systems. Progress made in the manufacture, test, evaluation, installation, problem resolution, performance evaluation, and development of these systems is described.

7727 (DOE/NASA/CR—150707) **Design data brochure: SIMS Prototype System 3.** (IBM Federal Systems Div., Huntsville, AL (USA)). 30 May 1978. Contract EX-76-A-29-1037. 41p. Dep. NTIS, PC A03/MF A01.

A closed hydronic solar system for space and hot water heating is described. Design, performance, and hardware specifications are presented sufficient for architectural engineers and contractors to procure, install, operate and maintain a similar solar application.

7728 (DOE/NASA/CR—150747) **Installation package for integrated programmable electronic controller and hydronic subsystem: solar heating and cooling.** (Andover Control Corp., MA (USA)). Aug 1978. Contract EX-76-A-29-1037. 165p. Dep. NTIS, PC A08/MF A01.

The Installation, Operation, and Maintenance Manual and information on the power panel and programmable microprocessor, a hydronic solar pump system and a hydronic heating hot water pumping system are included. These systems are integrated into various configurations for usages in solar energy management, control and monitoring, lighting control, data logging and other solar related applications.

7729 (DOE/NASA/CR—150770) **Solar heating and cooling systems design and development. Quarterly report No. 4, April 1, 1977—June 30, 1977.** (Honeywell, Inc., Minneapolis, MN (USA)). Jul 1978. Contract EX-76-A-29-1037. 87p. Dep. NTIS, PC A05/MF A01.

Honeywell is developing twelve prototype solar heating/cooling systems, six heating and six heating and cooling systems, two each for single family, multi-family, and commercial applications. This document contains the schedules and technical discussions, along with illustrations on the progress made from April 1, 1977 through June 30, 1977. Cost information has been removed from this report.

7730 (DOE/NASA/TM—78169) **Design and operation of a solar heating and cooling system for a residential size building.** Littles, J.W.; Humphries, W.R.; Cody, J.C. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). May 1978. Contract EX-76-A-29-1037. 35p. Dep. NTIS, PC A03/MF A01.

The first year of operation of the Marshall Space Flight Center's Solar House is discussed. Selected design information, together with a brief system description, is included. The house is equipped with an integrated solar heating and cooling system which uses fully automated state-of-the-art equipment. Overall performance for the first year is summarized. In addition, information pertaining to modifications made to improve performance is provided, and problems encountered during operation are discussed. Evaluation of data from the first year of operation indicates that the MSFC solar house heating and cooling system is capable of supplying nearly 100% of the thermal energy required for heating and approximately 50% of the thermal energy required to operate the absorption cycle air conditioner. The lower percentage of energy provided for the cooling mode as compared to the heating mode is due to the significantly higher temperature needed to operate the air conditioner, requiring the solar collector to operate at low efficiencies due to the higher inlet temperatures. Operation of the facility in the cooling mode has shown the need for basic subsystem improvements such as decreasing the operating temperature of the air conditioner and/or improving collector performance.

7731 (HCP/M70065—01/2) **Solar heating and cooling of buildings (SHACOB) commercialization report, Part A: options and strategies. Volume II. Technical report.** (Midwest Research Inst., Kansas City, MO (USA)). Jul 1977. Contract EM-77-C-01-8727. 186p. Dep. NTIS, PC A09/MF A01.

After an introductory section, the national and regional perspectives for SHACOB are presented. An overview of the participants in SHACOB commercialization is given. The problem of SHACOB commercialization is defined. Discussions of economic, institutional, legal, and other barriers constraining SHACOB commercialization are included. The analysis procedure and the baseline case are dealt with. Various analytical models are examined which project the future extent of SHACOB use (or SHACOB market penetration) and future SHACOB contributions to U.S. energy supplies under alternative government policies. The model used in this report is described in more detail. Possible ways are presented to overcome each of the barriers previously presented. A wide range of individual federal and state incentives that might accelerate SHACOB commercialization are examined. Qualitative analyses are

presented on incentives such as public education programs, financial education programs, the development of codes and standards, electric and gas utility programs, state incentives, user incentives, and producer incentives. Individual incentives are compared and combined into alternative policy strategies and options. (MHR)

7732 (HCP/M70065—01/3) **Solar heating and cooling of buildings (SHACOB) commercialization report, Part A: options and strategies. Volume III. Appendices.** (Midwest Research Inst., Kansas City, MO (USA); Department of Energy, Morgantown, WV (USA). Morgantown Energy Research Center). Jul 1977. Contract EM-77-C-01-8727. 179p. Dep. NTIS, PC A09/MF A01.

Volume III contains appendices which support the technical discussions in Volume II. These are: solar collector industry activities, solar commercialization activities at the state and local level, electric utility interface, description of the solar energy market penetration computer model, and comparison with other energy investments. (MHR)

7733 (LA-UR—78-1575) **Comparative economics of selective passive solar designs in residential space heating applications.** Roach, F.; Noll, S.; Ben-David, S. (Los Alamos Scientific Lab., NM (USA)). [nd]. Contract W-7405-ENG-36. 48p. (CONF-780639—6). Dep. NTIS, PC A03/MF A01.

From Analysis for solar heating and cooling; San Diego, CA, USA (27 Jun 1978).

One passive design, the thermal storage wall, is concentrated on. The economic performance of this design is examined and subsequently contrasted with one active design, the air collector/rock storage system. For the thermal storage wall two types of storage medium, masonry (Trombe) and water, are examined. An evaluation of night insulation for both storage mediums is included. The economic performance of these three systems is evaluated on a state-by-state basis. The section on methodology briefly reviews the architectural design criteria, solar performance characteristics, and the incremental solar cost of each solar system with emphasis placed on the thermal storage design. Also included is a discussion of conventional energy costs, as well as the optimal sizing/feasibility criterion employed in the economic performance analysis. Nationwide feasibility results are reviewed for each design. In addition to contrasting the solar systems themselves, the effects of two incentive proposals--the National Energy Plan (NEP) income tax credits and low interest loans—upon each design are examined. (MHR)

7734 (LA-UR—78-2228) **Control of a Rankine chiller and an absorption chiller in the National Security and Resources Study Center.** Hedstrom, J.C.; Murray, H.S.; Balcomb, J.D. (Los Alamos Scientific Lab., NM (USA)). 1978. Contract W-7405-ENG-36. 5p. (CONF-7805126—2). Dep. NTIS, PC A02/MF A01.

From Workshop on the control of solar energy; Hyannis, MA, USA (23 May 1978).

The National Security Resources Study Center (NSRSC) at Los Alamos, New Mexico, has 60,000 ft^2 of air-conditioned space, solar heated and cooled with an 8000 ft^2 array of flat-plate collectors. The collectors have a selective surface of black chrome and are single glazed with water-white glass. A paraffinic oil is used as the collector coolant, transferring heat to water through a heat exchanger. In the cooling mode, hot water is stored in a 5000 gallon pressurized tank and chilled water is stored in a 10,000 gallon tank. Two water chillers are installed in the system: a York lithium-bromide absorption unit (ESIA2), derated to 85 tons with 185°F water, and a Rankine cycle unit designed and fabricated by Barber-Nichols, rated at 77 tons with 200°F water. The chillers are installed in series with the 10,000 gallon cold storage tank. The mean daily values of measured energies in the NSRSC for 1978 are given. The percent solar cooling measured for the 1977 cooling season is August, 73 percent, and September, 92 percent. Observations on the system indicate that very little auxiliary energy is now used due to optimum management of solar energy and cold storage.

7735 (LA-UR—78-2280) **Brief comparison of the inherent capabilities of conventional controllers and linear-regulator controllers.** Farris, D.R.; McDonald, T.E.; Melsa, J.L. (Los Alamos Scientific Lab., NM (USA); Notre Dame Univ., IN (USA). Dept. of Electrical Engineering). 1978. Contract W-7405-ENG-36. 7p. (CONF-7805126—4). Dep. NTIS, PC A02/MF A01.

From Workshop on the control of solar energy; Hyannis, MA, USA (23 May 1978).

Inherent capabilities of conventional controllers and linear regulator controllers for solar HVAC systems are discussed and compared. It is shown that the basic requirements of solar heating and cooling control systems are met quite well by a linear regulator controller. It is also shown that the linear regulator yields a better control than conventional methods. Even though achieving this control requires a computing device, initial studies indicate that the computing requirements are probably not prohibitive. However, if computing requirements do present a limitation to implementation of the linear regulator controller, concepts and strategies learned from the linear regulator control can lead to more effective conventional control strategies.

7736 (LLL/M—086(Rev.1)) **Plant engineers solar energy handbook.** (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Jan 1978. Contract W-7405-ENG-48. 306p. Dep. NTIS, PC A14/MF A01.

This handbook is to provide plant engineers with factual information on solar energy technology and on the various methods for assessing the future potential of this alternative energy source. The following areas are covered: solar components and systems (collectors, storage, service hot-water systems, space heating with liquid and air systems, space cooling, heat pumps and controls); computer programs for system optimization local solar and weather data; a description of buildings and plants in the San Francisco Bay Area applying solar technology; current Federal and California solar legislation; standards, codes, and performance testing information; a listing of manufacturers, distributors, and professional services that are available in Northern California; and information access. Finally, solar design checklists are provided for those engineers who wish to design their own systems. (MHR)

7737 (SAND—78-0842) **Hazardous properties and environmental effects of materials used in solar heating and cooling (SHAC) technologies: interim handbook.** Searcy, J.Q. (ed.). (Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EX-76-C-04-0789. 226p. Dep. NTIS, PC A11/MF A01.

General background information related to SHAC systems, how a particular material was chosen for this handbook, and codes and standards are given. The following are included: classification scheme and general properties of materials used in SHAC systems; chemical composition, thermal degradation products, and thermoxidative products; toxic properties and other potential health effects of SHAC materials; fire hazard properties of SHAC materials; and environmental effects of and disposal methods for SHAC materials. Each chapter begins with a general discussion of the properties considered in that chapter, discusses the properties of specific categories of materials, and includes available data in tabular form with discussion of a specific category. Materials are categorized according to their functional use in SHAC systems as follows: heat transfer fluids and fluid treatment chemicals; insulation materials; seals and sealant materials; glazing materials; collector materials; and storage media. (MHR)

7738 (SAND—78-1097C) **Analysis and design of integrated SHAC systems via classical control theoy.** Alcone, J.M.; Kennish, W.J. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 16p. (CONF-7805126—1). Dep. NTIS, MF A01.

From Workshop on the control of solar energy; Hyannis, MA, USA (23 May 1978).

Portions of document are illegible.

Preliminary efforts at Sandia Laboratories to develop an analysis technique for integrated solar heating and cooling systems are presented. The method described accounts for mass effects in the system and yet maintains closed form procedures. The approach taken is to describe the system with a block diagram (in the Laplace domain) and then develop expressions for the transfer functions relating temperature load to insolation and ambient temperature inputs. Using frequency response techniques one can then determine what the response of the system should be for specific sinusoidal inputs. Design criteria are also developed from the analysis. To demonstrate the utility of the technique, a hypothetical structure located in Los Alamos, New Mexico is analyzed. Regionally dependent design criteria are developed and used to predict the performance of the above system.

7739 (SOLAR/0007—78/22) **Solar energy control system evaluation.** Bartlett, J.C. (International Business Machines Corp., Huntsville, AL (USA)). Jul 1978. Contract EG-77-C-01-4049. 6p. Dep. NTIS, PC A02/MF A01.

The International Business Machines Corporation is monitoring, evaluating, and reporting the performance of designated solar-energy systems. As a result of this data analysis and evaluation, information has accrued on the types of control system anomalies and failures that can occur in a solar-energy system. Three general classifications of the problems which cause such anomalies are discussed, and the means for correcting them are described. In light of the experience gained, the recommendation is made that existing solar-energy systems be reviewed to see if they are susceptible to the anomalies discussed. It is also recommended that the design of future systems take into account the ways in which the anomalies described can be prevented.

7740 (SOLAR/1009—77/12) **Monthly performance report.** (Greenmoss Builders, Inc., Waitsfield, VT (USA)). Dec 1977. Contract EG-77-C-01-4049. 13p. Dep. NTIS, PC A02/MF A01.

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The Greenmoss Builders Inc. solar-energy system located at Waitsfield, Vermont consists of a passive solar space heating subsystem and an active solar hot water subsystem installed in a single family residence with approximately 1000 square feet of living space. Accuracy of the performance results of the solar hot water subsystem is degraded substantially due to difficulties in measurement of the water flow through the system. The use of current measurements indicates a hot water consumption of approximately 648 gallons for the month. Assuming this much hot water demand, the solar preheat provided 16 percent of the demand or 0.062 million BTU, resulting in an estimated fossil energy savings of 104* cubic feet of gas. During December, the passive solar space heating subsystem provided approximately 21 percent of the energy requirements for space heating.

7741 (SOLAR/1015—78/03) **Monthly performance report.** (Perl-Mack Enterprises, Inc., Denver, CO (USA)). Mar 1978. Contract EG-77-C-01-4049. 14p. Dep. NTIS, PC A02/MF A01.

Portions of document are illegible.

Performance results are presented for a system to provide space heating and domestic hot-water preheating. The site is a single-family dwelling in Denver with 470 sq. ft. of flat plate collectors with a water-glycol heat transfer medium. The energy is stored in a 945-gallon tank after passing through a liquid-to-liquid heat exchanger. The system is shown schematically and its five modes of operation are described. In March solar energy supplied 61, of the combined heating and hot-water demand of 3.61 million Btu. (MHR)

7742 (SOLAR/1015—78/04) **Monthly performance report.** (Perl-Mack Enterprises, Inc., Denver, CO (USA)). Apr 1978. Contract EG-77-C-01-4049. 14p. Dep. NTIS, PC A02/MF A01.

Performance results are presented for a system to provide space heating and domestic hot-water preheating. The site is a single-family dwelling in Denver with 470 sq ft. of flat plate collectors with a water-glycol heat transfer medium. The energy is stored in a 945-gallon tank after passing through a liquid-to-liquid heat exchanger. The system is shown schematically and its five modes of operation are described. The measured demand for space heating during April was 0.58 million Btu, 0.51 million Btu (88 percent) of which were provided by the solar-energy system. Solar energy supplied 67 percent of the hot water load of 1.71 million Btu. (MHR)

7743 (SOLAR/1015—78/05) **Monthly performance report.** (Perl-Mack Enterprises, Inc., Denver, CO (USA)). May 1978. Contract EG-77-C-01-4049. 16p. Dep. NTIS, PC A02/MF A01.

Performance results are presented for a system to provide space heating and domestic hot-water preheating. The site is a single-family dwelling in Denver with 470 sq ft. of flat plate collectors with a water-glycol heat transfer medium. The energy is stored in a 945-gallon tank after passing through a liquid-to-liquid heat exchanger. The system is shown schematically and its five modes of operation are described. Solar energy satisfied 64 percent of the combined heating and hot-water demand of 2.94 million Btu in May. (MHR)

7744 (SOLAR/1015—78/21) **Thermal performance of the Perk—Mack Enterprises Inc. solar energy system.** (International Business Machines Corp., Huntsville, AL (USA)). Jul 1978. Contract EG-77-C-01-4049. 13p. Dep. NTIS, PC A02/MF A01.

The Perl-Mack Enterprises, Inc. solar-energy system in Denver, CO, and its modes of operation are described briefly, and then a performance evaluation of the system is presented. The evaluation is based on comparison of predictions of climatic, load, and operational conditions with those measured at the site. The technique for determining the thermal performance is presented. Associated documentation is described, and seasonal as well as typical monthly data are presented. These data are then briefly analyzed to produce an evaluation of the system performance.

7745 (SOLAR/2002—78/07) **Monthly performance report.** (Radian Corp., Austin, TX (USA)). Jul 1978. Contract EG-77-C-01-4049;EX-76-C-01-2396. 14p. Dep. NTIS, PC A02/MF A01.

The Radian solar energy system is designed to heat and cool approximately 800 square feet of office and laboratory area in a two story, modern office building in Austin, Texas. The system utilizes 36 Northrup tracking concentrating collectors which provide an effective aperture area of 350 square feet with a gross collector array area of 1380 square feet. The working fluid, water in summer and water/glycol in winter, is pumped from the collectors to a heat exchanger between the collectors and the storage tank. A 1500 gallon insulated fiberglass storage tank is located above ground on a concrete pad near the building. The solar cooling equipment for the system is an Arkla 3-ton packaged absorption air-cooler located on the second floor of the building and a cooling tower on the roof. The system, shown schematically, has three modes of solar operation. The Radian solar system has been inactive for the entire month due to a collector tracking failure. (MHR)

7746 (SOLAR/2003—78/07) **Monthly performance report.** (Scattergood School, West Branch, IA (USA)). Jul 1978. Contract EG-77-C-01-4049;EX-76-C-01-2386. 14p. Dep. NTIS, PC A02/MF A01.

The solar system designed to supply 75 percent of the average annual energy requirements for space heating the gymnasium and for heating the hot water for an adjacent locker room. Solar heating is also available for a grain-drying silo retrofitted at the site. The site has array of 2496 sq ft. of flat-plate solar air heaters, a heat storage bin of 130,000 pounds of rocks, and 2 120-gallon water preheating tanks. The five modes of solar operation are described. The Scattergood solar energy system satisfied 99 percent of the combined heating and hot water demand of 3.9 million Btu in July. (MHR)

7747 (SOLAR/2003—78/23) **Thermal performance of the Scattergood School solar energy system.** Shenfish, K.L. (International Business Machines Corp., Huntsville, AL (USA)). Jul 1978. Contract EX-76-C-01-2386;EG-77-C-01-4049. 14p. Dep. NTIS, PC A02/MF A01.

Summary operational performance evaluation results are presented for the Scattergood School solar-energy system for the period September, 1977, through April, 1978. This evaluation is based on comparison of measured values of thermal performance and climatic conditions with predicted and long-term average values for the system. The technique used for determining the thermal performance is presented as is a brief system description. The space heating subsystem satisfied 86 percent of the space-heating demand of 107.3 million BTU. A failure in the air-to-water heat exchanger of the hot-water preheat subsystem is discussed.

7748 (SOLAR/2015—78/14) **Solar energy system performance evaluation: Kalwall Corporation Warehouse, Manchester, New Hampshire, November 1977—April 1978.** Weston, M.W.; Morris, T.D.; Murphy, L.J. (International Business Machines Corp., Huntsville, AL (USA)). Jul 1978. Contract EX-76-C-01-2372;EG-77-C-01-4049. 31p. Dep. NTIS, PC A03/MF A01.

The results of a seasonal analysis of the thermal performance during heating season of the Kalwall Corporation passive solar space heating system located in Manchester, N.H. are presented. The heated space at this site consists of a retrofitted portion of an existing single-story commercial warehouse. Solar energy enters the building through the south and east walls of the warehouse, which are constructed of a double-panel glazing. Storage is provided in this direct gain system by the exposed concrete floor of the building and by the contents of the warehouse. Circulating fans located near the top of the south wall provide the capability to aid in distribution of energy in the building. Auxiliary energy is provided by a hot water/steam system with two fan-powered liquid-to-air heat exchangers. A large door on the east wall provides access to the warehouse. A summary of the results obtained from the performance analysis is presented. The application of the performance evaluation technique to the site along with problems encountered during the analysis are described. The detailed results of the analysis are described. Solar energy provided 58% of the heating load.

7749 (SOLAR/2018—78/07) **Monthly performance report.** (Reedy Creek Utilities Co., Inc., Lake Buena Vista, FL (USA)). Jul 1978. Contract EX-76-C-01-2401. 18p. Dep. NTIS, PC A02/MF A01.

The Reedy Creek site is a two-story, 5625 sq. ft. concrete block office building located in Lake Buena Vista, Florida. The solar energy system is designed to provide 100 percent of the space heating and domestic hot water demands and 80 percent of the space cooling demand. The collector subsystem is composed of an array of parabolic trough collectors with tracking absorber tubes forming an integral part of the building's roof, and oriented with its major axis in an east-west direction. The total collector aperture area is 3840 sq. ft. Water is used as the heat collection, transfer, and storage medium. Collected solar energy is stored in a 10,000 gallon hot water tank. Domestic hot water is provided by a heat exchanger immersed in this tank. Space heating is provided by circulation of hot water from the storage tank through heat exchangers located in the central air distribution system. No auxiliary energy is provided for either domestic hot water or space heating. A 25 ton absorption cycle water chiller utilizes hot water from storage to provide chilled water to a 10,000 gallon cold water storage tank. The system, shown schematically, has 5 modes of solar operation, which are described. The total measured month cooling demand was 51.4 million Btu, of this the solar system provided 12.7 million Btu. The domestic hot water system operated successfully, providing water at approximately 140°F on demand. (MHR)

7750 **Multivalent heating system with a solar collector, a heat pump, and an auxiliary system.** Sudhoelter, H. (to Bitter (W.), Bielefeld (Germany, F.R.)). German(FRG) Patent 2,638,357/B/. 15 Jun 1978. 5p. (In German).

The invention pertains to a multivalent heating system with a solar collector, a heat pump, an auxiliary heating, and a mixing value

in the flow line of the system. The mixing value is actuated by a servomotor. The servomotor is controlled via a measuring system which continuously compares ambient temperature and flow temperature and regulates the flow temperature in accordance with a given heating curve. The control system is not only simple, cheap and reliable, but also offers the possibility of connecting the three energy sources solar collector, heat pump, and auxiliary heating to a heat storage tank so that solar energy can be utilized also in the colder season.

7751 Constructional physics for solar houses. Milborn, G. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 13-14(May-Jun 1978). (In German).

The article deals with problems of constructional physics in connection with the utilisation of solar energy for space heating. Discussed are: problems of thermal insulation and heat storage, with a discussion of the effects of windows and ventilation on the thermal economy. Architectural measures may help to achieve an optimum utilisation of solar energy. Finally, problems of heating technology are discussed.

7752 Low-temperature heating systems and solar energy. Urbanek, A. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 16-18(May-Jun 1978). (In German).

Economical heat supply in buildings is only possible if low-temperature systems are used. Solar heating systems are optimal for this temperature range as the heat gain of the solar collectors is decisively influenced by the flow temperature of the heating system connected in series. In particular, operational values are good in combination with a hot-water floor heating system. Favourable operating conditions are also achieved in connection with heat pumps.

7753 What type of hot-water floor heating. Urbanek, A. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 21-22(May-Jun 1978). (In German).

The choice of a low-temperature heating system in a new building is an important investment for the present or future utilisation of solar energy for domestic heating. The heating systems of 10 different firms are presented in a survey article.

7754 School heated with solar energy. 80 m² collector surface are to save 18,000 l heating fuel annually in Pfaffenhofen/Ilm. Mueller, F. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 31(May-Jun 1978). (In German).

The author describes a solar plant which supplies hot service water to the swimming pool of a school, its hot-water floor heating, and its showers. The collector surface is 80 m². The collectors are single-glazed, with a selectively coated aluminium roll-bonded bottem plate as absorber. There is a heat storage tank for a constant flow temperature of 36°C in all consumers. The solar plant has a power of about 65 kW. Up to 18,000 l heating fuel oil can be saved per year. With investment costs of 60,000 DM, the amortisation time will be 11 years.

7755 How a gable became a solar roof. An architect in the Munich area acquires a south roof. Urbanek, A. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 33-35(May-Jun 1978). (In German).

A solar system is described which was installed in the gable of a house where the ridge of the roof runs from north to south. The installation is used for swimming pool heating, water heating, and floor heating. A storage tank with a volume of 8 m³ and a service water tank with a volume of 210 l are integrated in the system. The collector surface is 40 m². According to the calculations, about 50% of the 50,000 kWh/a will be supplied by solar energy. With investment costs of 28,000 DM, the amortisation time will be 12 years.

7756 Use of solar energy and environmental heat for space and water heating. Kalischer, P. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt. Anwendungstechnik). *Elektrowaerme Int., Ed. A;* **36**: No. 2, 87-92(Mar 1978). (In German).

The author first outlines the availability of solar energy in West Germany in comparison with other regions. The possibilities to make direct use of solar energy are discussed along with the indirect use by recovering heat from the environment, for which purpose heat pumps are employed. These withdraw heat from water, ground or the atmosphere and can be operated as single or dual-source units. Energy balances and investment cost are given for both direct as well as indirect use of solar energy. The conclusion is that the recovery of heat by heat pump is superior to the use of solar energy in terms of investment cost and at least equal to it in terms of energy gain.

7757 What are the possible applications of direct use of solar energy for air conditioning technology in central Europe. Hauff, V. (Bundesministerium fuer Forschung und Technologie, Bonn-Bad Godesberg (Germany, F.R.)); Ziegenbein, B. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)); Cube, H.L. von; Lehner, G. *Klima Kaelte Ing.;* **6**: No. 4, 143-145(1978). (In German).

Within the framework of the Ki forum, the Minister for Research and Technology as well as representatives of research, industry and unions answer the questions: estent of the usability of solar energy for room heating; prospects for solar refrigeration; and main problems of solar energy in room heating supply and refrigeration. The answers are very different. The necessity of storage and the indispensability of a bivalent system regarding room heating is indicated. The combination of solar energy plus heat pumps is unanimously positively agreed upon.

7758 Safety requirements on solar heating systems and heat carriers. *Sanit. - Heizungstech.;* **43**: No. 2, 104-107(1978). (In German).

The demands to be made on solar heating plants and their components with regard to quality, materials, and safety are discussed. This paper, which was read at the ZVSHK meeting in Bad Godesberg in early November, 1977, lists plant data and practical aspects in the framework of a comparison and evaluation.

7759 Passive solar heating and cooling systems. Yellott, J.I. (Arizona State Univ., Tempe (USA). Coll. of Architecture). *Klima Kaelte Ing.;* **6**: No. 4, 147-154(1978). (In German).

A translation of the lecture held at the ASHRAE-meeting (Halifax, June 77) is presented. The original was published in the ASHRAE-Journal 20 (1978)1, p. 60-67. At the beginning, the author introduces several ways of definition, thus coming to a classification with three mainly passive systems. These systems have in common that they use the building structure as a collector and can do without using pumps and ventilators for the water- and air circulation. Using examples from the USA, completed systems are described and obtainable heat gains are discussed.

7760 Solar refrigeration for air conditioning installations. Loewer, H. (Fachhochschule Giessen (Germany, F.R.). Fachbereich Technisches Gesundheitswesen). *Klima Kaelte Ing.;* **6**: No. 4, 155-162(1978). (In German).

From 1. German solar forum with exhibition; Hamburg, Germany, F.R. (23 - 28 Sep 1977).

The wording of a lecture at the 1st solar forum (Hamburg, Sept. 1977) has been extended by the results of a study trip in the USA. Various methods of refrigeration have been tested for their usability: steam jet, compression and absorption refrigerators with LiBr, whereby developments in the USA are particularly dealt with. The various development lines are presented in detail and critically examined regarding their technical maturity, efficiency and possible uses. The necessary types of collectors are also dealt with. Finally, the possibility of conversion to room heating is discussed.

7761 Passive solar design. Anderson, B.N.; Michal, C.J. (Total Environmental Action, Inc., Harrisville, NH). *Annu. Rev. Energy;* **3**: 57-100(1978).

A brief outline is given of passive solar systems: their definition, applications, performance, and costs. Five generic systems discussed are direct gain; convective loops; thermal storage walls; roof ponds; and attached greenhouses. Specifics of some passive schemes are also discussed. 11 references. (LBS)

7762 Energy and room climate - points of approach for a new architecture. Schaefer, U. *Bauen Wohnen;* **32**: No. 7/8, 251-253(1977). (In German).

A discussion of ways to directly utilize solar energy, not only via solar collectors, but by means of the building material, via walls, floors, and ceilings is given. Guiding ideas for a solar house that can save 60% fuel with the right building materials, suitable orientation, and the right windows, even without mechanical measures and without solar collectors are given. Development should lead from complicated mechanisms to more simple means in solar energy utilization.

7763 Rules of thumb for the design of solar heating systems. Schmieder, P. *IKZ Fachz. Sanit.-Heiz.-Klima;* **32**: No. 17, 38, 40, 42, 44(1977). (In German).

Without becoming too scientific, the economic utilization of solar energy is dealt with. To start with, some facts are presented. Then solar radiation is discussed; direct radiation, diffuse radiation, global radiation. The technical possibilities to use solar energy are provided with the aid of solar collectors which are described. A solar heating system is discussed. Information is given on the design of components. A simplified calculation example concludes the article.

7764 Cost effective solar augmented heat pump/power building systems. Meckler, M. (Energy Group, Inc., Los Angeles). pp 118-133 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

The problem of integration of some promising solar augmentation concepts with conventional building heating, ventilating, and

air conditioning and power systems is discussed. The following topics are discussed: solar variability, thermodynamic availability, heat pumps, Rankine cycle engines, chemical dehumidification potentials, operating cycles, dynamic storage potentials, selecting solar collectors for power options, and solar system costs and market projections. (MHR)

7765 **NMSU: Casa Del Sol of the future.** Horak, H.L. (New Mexico State Univ., Las Cruces). pp 151-156 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

A solar heated and cooled experimental residence has been built on the campus of New Mexico State University. The house is of energy conserving design, of southwestern architectural style and has an integrated solar system. A computer model has been developed for the thermal performance of the house and solar system. It is composed of two basic parts, a house load and a mechanical system heat balance section. The load section determines the heat conduction through the walls and roofs using a one-dimensional transient finite different technique. The interior heat, infiltration and filter loads are calculated from empirical relations. The load imposed by incident sunlight on any of the outside surfaces of the house is determined by a separate subprogram. The mechanical system model solves heat balance equations for each component of the solar system simultaneously. This is accomplished for each time increment and uses a Runge-Kutta integration technique. A comparison has been made of the operational predictions of the analytical model with the actual design that was developed and built. The existing system was designed based on typical engineering. The model study indicates that the existing system was sized well at very nearly the optimum for this climatological region.

AGRICULTURAL AND INDUSTRIAL PROCESS HEAT

REFER ALSO TO CITATION(S) 7704, 7746, 7747, 7783, 7795, 7808, 7861

7766 (CONF-770953—, pp 8.15-8.20) **Concentrating collector system to supply industrial process hot water.** Ameduri, G. (Solar Energy Engineering, Poland, OH); Rost, D.F.; Alexander, C.K.; Schuler, H.F. 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Solar Energy Engineering has recently completed the engineering design, installation and preliminary test results of a concentrating collector system integrated into an industrial process hot water application. A 408 m^2 (4,400 ft^2) array of General Solar Systems Division of General Extrusions, Inc. own, design and manufacture Limited-Tracking Concentrator (3.67 : 1 concentration ratio) was built and installed on General Extrusions' roof in Youngstown, Ohio. This array is integrated into a solar-direct and solar-assisted heat pump system with storage to provide energy to a 77°C (170°F) 3,656 gallon alkaline cleaning tank. Energy requirements for this application are 1.9 x 10^9 Btu's per year. The concentrating collector in this system is the General Solar Systems/Solar Energy Engineering limited tracking concentrating solar collector. It features five cycles of a half parabola shape in a 3.0 m by 1.36 m, lightweight module. It requires no expensive tracking mechanism and is easily realigned in seven positions to produce maximum performance throughout the year. The energy output of the 408 m^2 array will be transferred to the alkaline cleaning tank through heat exchangers and a specially designed Westinghouse Templifier industrial liquid-to-liquid heat pump. This system, as designed, is extremely flexible and can operate in a number of different modes and can produce output energy in the temperature range of 60 to 93°C (140 to 200°F). Because of the corrosiveness of the cleaning solution, the entire system is stainless steel and CPVC. This demonstrates the versatility of the system to handle a variety of industrial applications. The system is capable of producing over 500,000 Btuh (146 kw) at 88°C (190°F) during a sunny noon-time.

7767 (CONF-770953—, pp 8.29-8.34) **Concentrating collectors applied to the industrial process of textile drying.** Mitchell, P.D.; Gupta, B.P. (Honeywell Inc., Minneapolis). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The first phase of this ERDA Solar Industrial Process Heat Program has resulted in the detailed design of a solar energy collection system for providing process heat to a textile drying process. The solar collection subsystem uses 700 square meters of parabolic trough, single axis tracking, concentrating collectors to heat water in a high temperature water (HTW) loop. At the system design point (clear day) the solar collectors nominally generate 198°C water with the HTW loop at 2 x 10^6 Pa. A steam generator is fueled with the HTW and produces 490 kg/hr of process steam at the nominal design point conditions. The generated process steam is at 0.5 x 10^6 Pa and 160°C. The solar system will provide 1.2 x 10^6 MJ/yr to the process. This is 41% of the direct insolation available to the collector field during the operational hours (300 days/year) of the Fairfax mill. The process being solarized is textile drying using cylindrical can dryers. The can dryers are part of a "slashing" operation in a West Point Pepperell mill in Fairfax, Alabama. Over 50% of all woven goods are processed through slashers and dried on cylindrical can dryers. Furthermore, since can dryers are also used in other drying processes, this application of solar energy to process heat is one that shows high potential for having a significant impact on displacing conventional fuels.

7768 (CONF-770953—, pp 9.31-9.38) **Performance and cost of solar industrial process heat systems utilizing the parabolic-cylinder collector.** Ludwig, D. (InterTechnology/Solar Corp., Warrenton, VA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

InterTechnology/Solar Corporation has evaluated the technical performance and life-cycle cost of a solar thermal system to produce industrial process heat utilizing the parabolic cylinder. The work was conducted under contract with Energy Research and Development Administration with the aim of evaluating the potential and problems of solar-supplied industrial process heat. A comparison of the performance and cost factors for flat-plate, compound-parabolic, low-concentration Fresnel lens, parabolic-cylinder, and solar pond collectors showed the parabolic-cylinder collector to be the most cost-effective collector for solar-supplied industrial process heat applications above 175°F. For applications below 175°F, a well-designed, single-glazed, black-chrome-coated, flat-plate collector is the most economical system even though the usable energy produced is less than that produced by the parabolic cylinder. The system studies were performed at six locations representative of six constant-performance solar regions covering the United States. Performance and cost factors were computed for a wide range of solar fractions of load and process temperature requirements ranging from 125°F through 500°F. For example, a system supplying 50% of a 400°F (from 60°F) process energy requirement, collector output ranged from 219,000 Btu/ft^2-yr in Schenectady, New York, to 613,000 Btu/ft^2-yr in El Paso, Texas. The marginal costs of solar energy produced for the two locations are \$8.00/10^6 Btu and \$2.40/10^6 Btu, respectively. These figures represent the current life-cycle value of delivered conventional fuel cost required for the solar system to be cost-competitive.

7769 (SOLAR/2005—77/14(Rev.A)) **Solar energy system performance evaluation. Iris images: interim report, Revision A.** (International Business Machines Corp., Huntsville, AL (USA)). Nov 1977. Contract EG-77-C-01-4049. 47p. Dep. NTIS, PC A03/MF A01.

A detailed performance evaluation, based on instrumented data collected between June 1977 and September 1977, of the Iris Images solar energy system has been completed. During this analysis it was found that excessive losses are occurring from uninsulated pipes and manifolds between the collector and the pre-heat tanks. It should be noted that the original design specified insulation in these areas, but that this insulation was left off to accommodate the installation of the instrumentation system. In addition, it was discovered that the collector controller is unstable in periods of low insolation because its set points are mismatched. A TRNSYS simulation model was developed and used to predict fossil energy savings of 140 million Btu per year. Recommendations were made to insulate the pipes and manifolds, as designed, to reduce the energy losses and increase system performance. It was also recommended that the collector controller set points be changed to prevent premature failure of the pump. In addition to the recommendations for system changes, it was also recommended that the performance evaluation be continued in order to evaluate the system under a wider range of operating conditions and to validate the simulation model.

7770 (TID—28745) **Application of solar energy to the supply of industrial hot water. Volume II. Appendix to the final design report.** (Jacobs Engineering Co., Pasadena, CA (USA)). 31 Jan 1977. Contract EY-76-C-03-1219. 475p. Dep. NTIS, PC A20/MF A01.

The appendices for the conceptual design of a solar system for integration into the process hot water and steam services for the laundry facility, American Linen Supply, located in El Centro, California are presented. Included are: solar collector information, specifications, and design drawings; energy reduction analyses data; tables of insolation data; 36 system design drawings, analysis of heat transfer fluids, analysis of thermal insulation, design of system components, design of control system, design of electrical systems, and maintenance and repair; diagrams of instrumentation system; structure drawings and specifications; project organization chart construct schedule; method and results of economic analysis for com-

parison of solar process heat systems; and information on personnel involved. For Volume I, see TID-27808. (MHR)

7771 Preliminary assessment of nontechnical issues related to industrial application of solar-thermal-energy systems. Watkins, G.A.; Brown, M.L.; Maiden, B.; Moore, J.; Smail, H.; Solomon, S. (Battelle's Columbus Labs., OH). pp 134-146 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

A preliminary assessment of nontechnical issues related to industrial application of solar-thermal energy systems (SES) was performed. The assessment was made through review of the literature and contacting 100 individuals in 33 industries, public agencies, and others throughout the United States. There were three substantive areas and ten issues addressed in this preliminary assessment of non-technical issues. First, economic issues assessed were as follows: (a) technical uncertainties of SES; (b) non-compatibility of heat requirements; (c) cost differentials; (d) present need for incentives; and (e) industry investment criteria. The institutional portion of this study assessed the "need for government incentives" to promote SES in industry by reducing private risk. It also assessed the "impact of regulatory action" relating to building codes, zoning restriction, and water resource allocation. Finally, environmental issues for which a preliminary assessment was conducted included "system land requirements", "ecological effects of glare", and "reduction in pollution from alternative process heat sources".

WATER HEATING

REFER ALSO TO CITATION(S) 7703, 7707, 7708, 7711, 7712, 7716, 7722, 7727, 7736, 7740, 7741, 7742, 7743, 7744, 7746, 7747, 7749, 7754, 7755, 7756, 7788, 7822

7772 (DOE/NASA/CR—150544) **Sims Prototype System 2 test results: engineering analysis.** (IBM Federal Systems Div., Huntsville, AL (USA)). Jan 1978. Contract EX-76-A-29-1037. 47p. Dep. NTIS, PC A03/MF A01.

Portions of document are illegible.

System 2 is a liquid, non-draining solar energy system for supplying domestic hot water to single family residences. System 2 consists of collectors, storage tank, heat exchanger, pumps and associated plumbing and controls. A silicone fluid circulated through the collectors absorbs heat energy which is transferred by way of the double wall heat exchanger to potable water in the preheat tank. The solar heated water is stored in the preheat tank until needed to service a standard domestic hot water heater. The standard hot water heater serves as a backup for the system by adding any necessary energy to bring the domestic hot water to approximately 140°F. Prototype System 2 was tested at the MSFC Solar Test Facility during September and early October 1977. The major objectives of the test are: (1) to verify the system installation techniques, operation and performance; (2) to verify the adequate performance of the individual marketable subsystems; and (3) to provide a general test data base for comparison with field data from the Togus, Maine site. The testing which was done, the problems encountered, and the results and conclusions obtained are presented and discussed.

7773 (DOE/NASA/CR—150545) **Prototype solar domestic hot water systems (a collation of quarterly reports).** (Solar Engineering and Mfg. Co., Fort Lauderdale, FL (USA)). Feb 1978. Contract EX-76-A-29-1037. 20p. Dep. NTIS, PC A02/MF A01.

A collection of quarterly reports from Solar Engineering and Manufacturing Company (SEMCO) is presented covering the period from November 1976 through September 1977. SEMCO is developing two prototype solar domestic hot water systems consisting of the following subsystems: collector, storage, control, transport, and auxiliary energy. These two systems are being installed at sites in Loxahatchee, Florida and Macon, Georgia.

7774 (DOE/NASA/CR—150591) **Prototype solar heated hot water systems an double-walled heat exchanger (a collection of quarterly reports).** (Elcam, Inc., Santa Barbara, CA (USA)). Jan 1978. Contract EX-76-A-29-1037. 36p. Dep. NTIS, PC A03/MF A01.

This report is a collection of quarterly reports from Elcam, Inc., covering progress made from September 1976 through December 31, 1977. Elcam is developing two solar heated hot water prototype systems and two heat exchangers. This effort consists of development, manufacture, installation, maintenance, problem resolution, and system evaluation.

7775 (DOE/NASA/CR—150605) **Preliminary design package for sunspot domestic hot water heating system.** (Elcam, Inc., Santa Barbara, CA (USA)). Nov 1976. Contract EX-76-A-29-1037. 114p. Dep. NTIS, PC A06/MF A01.

This report is a collation of documents that were submitted by Elcam, Inc., for the preliminary design review on the Sunspot Domestic Hot Water System. Included are a drawing list, autocontrol logic, measurement definitions, and other documents pertaining to the preliminary design of the system. Elcam has developed two solar heated prototype hot water systems and two heat exchangers. The hot water systems consist of the following subsystems: collector, storage, control transport, auxiliary energy and government-furnished Site Data Acquisition. The two systems are being installed at Tempe, Arizona, and San Diego, California.

7776 (DOE/NASA/CR—150699) **Design data brochure: solar hot water system.** (Solar Engineering and Mfg. Co., Fort Lauderdale, FL (USA)). Jul 1978. Contract EX-76-A-29-1037. 21p. Dep. NTIS, PC A02/MF A01.

This Design Data Brochure is general in nature. The intent is to provide a preliminary, not too technical, approach to a subject that can be technically demanding. The example used for the design calculation has been for a single-family residence housing a family of four in a nonspecific geographical area. Drain-down freeze protection is used with the flat plate collectors. Drawing and specifications for the solar collectors, valves, pump, and flow regulators are included.

7777 Solar swimming pool heating. Urbanek, A. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 23-28(May-Jun 1978). (In German).

In a few years, there will be hardly any swimming pools without solar energy supply. The low flow temperature required for swimming pool heating is a point in favour of the use of cheap solar collectors whose efficiency is high due to the low flow temperature. In addition, the control mechanism of the solar plant is very simple; they can be easily made as homemade construction. The different water heating conditions in private open-air swimming pools, public swimming pools and indoor swimming pools require suitable heating systems, and if necessary, these may be bivalent heating systems.

7778 Offer of swimming pool collectors. Urbanek, A. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 29(May-Jun 1978). (In German).

The increasing trend towards solar energy supply to swimming pools results in an increased offer of such plants. The article gives a survey of swimming pool collectors suitable for the heating of swimming pool water.

7779 Solar house at Lohr. With 17 m² collector surface more than 3000 l heating fuel are saved annually. Grimm, P. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 35(May-Jun 1978). (In German).

The solar plant described here is used for swimming pool energy supply and hot water supply in a domestic building with a business undertaking. The collector surface is 17 m². The thermal energy is stored in a 450 l tank. With investment costs of 9500 DM, the amortisation time will be 9 years; the installation has a service life of 25 years. About 3000 l heating fuel oil are saved per year.

7780 Selection, planning and assembly of solar plants with flat roof collectors. Braehler, M. (Herget (W.) K.G., Solartechnik, Eichenzell (Germany, F.R.)). *Klima Kaelte Ing.;* **6**: No. 4, 127-130(1978). (In German).

A general survey on selection and assessment criteria for solar plants to produce hot water is given. The necessary roof area, roof alignment and sloping, shading as well as building legalities and safety specifications are indicated related to the suitability of the building plan. Information is given on choice of collector regarding the collector cover plates requirements, the coating of the absorber layer, response behaviour as well as heat insulation of the collector case. Finally, requirements made of the heat exchanger, storer, heat carrier and control system are formulated.

OTHER

REFER ALSO TO CITATION(S) 7805, 7853

7781 (CONF-770953—, pp 4.13-4.15) **400 KW high temperature solar test facility.** Brown, C.T. (Georgia Inst. of Tech., Atlanta). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A 400 KW Solar Thermal Test Facility, owned by ERDA and operated by Georgia Tech, has been completed on the Georgia Tech campus. Its features include a hexagonal array of 550 mirrors driven mechanically to track the sun, a central tower for test apparatus and a computerized data acquisition system. Maximum radiation flux density is expected to be about 300 w/cm². By March 1978, a second tower, capable of supporting heavier loads, will be built south of the mirror field. The first test, that of a 530 KW Francia type receiver, is presently underway and will be completed

by January 1978. Other users are being encouraged to schedule tests at the facility.

7782 (CONF-770953—, pp 5.105-5.112) **Turbo-gearboxes for solar Rankine engines.** Barber, R.E. (Barber-Nichols Engineering Co., Arvada, CO). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Turbine expanders are used by Barber-Nichols in solar air conditioning and irrigation systems because they offer: (a) the highest cycle efficiency since R-113 can be used in the Rankine loop; (b) good performance with low prototype cost; and (c) low cost in production. Development work is being carried on in the area of seals, and low loss and cost gearboxes. Photographs are presented of 4 hp and 25 to 100 hp gearboxes as examples. Solar Rankine engines for air conditioning (with flat plate collectors) are presented that have demonstrated COP's of 0.45 to 1.2. Photographs are presented of these air conditioners and of a 25 hp irrigation engine that operates with concentrating collectors and has a cycle efficiency of approximately 15%. Development is progressing on improved 3 ton and 25 ton air conditioning units (for use with flat plate collectors), a 100 ton water chiller, and a 4 hp pumping unit (for use with concentrating collectors).

7783 (CONF-770953—, pp 8.1-8.13) **Acurex concentrates on solar energy.** Rossiter, E. (Acurex Corp., Mountain View, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Several thermal applications for solar systems are described, including irrigation pumping, process hot water, and process steam. The design and construction of the 25-hp solar irrigation system at Willard, New Mexico is discussed in some detail. Some aspects on the economics and costs for systems are presented.

7784 (UCID—17804-77, pp 19-26) **Engineering feasibility of an irrigation pumping plant using shallow solar ponds.** Platt, E. 18 May 1978.

In Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.

Energy from shallow solar ponds is evaluated as possible alternative to purchased power for irrigation on farms. The relatively low temperature heat could be used to run a Freon engine of the waste-heat-recovery type coupled to a generator or well pump, or both. (MHR)

SOLAR COLLECTORS AND CONCENTRATORS

REFER ALSO TO CITATION(S) 7693, 7696, 7701, 7724, 7766, 7767, 7768, 7778, 7784

7785 (ALO—4158-1) **Solar parabolic trough forming process. Final technical report.** Williams, O.G.; Skaggs, R.L. (Williams (O.G.) and Skaggs (R.L.), Las Vegas, NV (USA)). 31 May 1978. Contract EG-77-G-04-4158. 58p. Dep. NTIS, PC A04/MF A01.

Eight foot and six foot long solar parabolic shells were formed from thin aluminum sheet by using this entirely new forming process, exceeding 8/1 concentration. Expanding on work previously done, many variables were investigated. Using one foot long trough samples, a high degree of slope accuracy was obtained. One laser beam scan sample showed a 75/1 concentration ratio based on receiver diameter, and a 24/1 concentration ratio based on receiver circumference. The forming process eliminated the need for ribs, boxes or other devices now used to maintain the parabolic shape of a solar parabolic shell. The process, in brief, involves (1) Alloy Aluminum; (2) Moments; (3) Temperature; (4) Time; (5) Thickness; (6) Bearings; (7) Flange Angle Bend; (8) Hardness; (9) Lengthwise Sag; (10) Material Flatness; (11) Aperture Control. A large, forming fixture was built. Although it was sufficient to produce the shells needed, it should be modified and improved. The process allows for large manufacturing tolerances which were helpful with this fixture. The small, sample testing fixtures were satisfactory, as is. Flanges add strength and provide a flat surface across which the end and receiver support is attached. This simplifies and reduces the cost of the end supports.

7786 (CONF-770487—) **Testing of solar collectors and systems.** (Royal Institution, London (UK)). 1977. 82p. Dep. NTIS (US Sales Only), PC A05/MF A01.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

Six papers are included. A separate abstract was prepared for each paper. (MHR)

7787 (CONF-770487—, pp 1-13) **Some aspects of testing the thermal performance of collectors.** Justin, B. (Pilkington Bros. Ltd., Ormskirk, Eng.). 1977.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

In Testing of solar collectors and systems.

Some of the problems encountered when evaluating the thermal performance of a flat plate collector and the method proposed by the American National Bureau of Standards for evaluation of collector performance are outlined. It may be, in the light of further experiences, that alternative procedures may be developed and/or additional tests need to be carried out. The proposed standard test presently being drafted by ASHRAE is based on the NBS but includes two additional tests, one to determine the collector's "time constant" and the other to determine the "incident angle modifier" which should enable the performance of a collector to be predicted under a wide range of conditions. Also it may be possible to develop techniques for normalizing the test results produced by the NBS procedure to standardized conditions in order to eliminate possible variations between test centers. The NBS proposed standard forms an excellent starting point for any thinking in this area and should be taken into consideration in moving towards a British standard testing procedure, bearing in mind that the ultimate goal should be to enable comparisons of performance data to be carried out on an international basis.

7788 (CONF-770487—, pp 15-30) **Measurement in solar collector testing.** Wozniak, S.J. (Building Research Establishment, Garston, Eng.). 1977.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

In Testing of solar collectors and systems.

An outline is given of the types of equipment that could be used for determining the thermal performance of solar water heating collectors. Sources of possible error are highlighted and several procedures suitable for validating and calibrating measuring equipment are briefly described. It is concluded that considerable care is necessary in both selecting and using measuring equipment if accurate results are to be obtained.

7789 (CONF-770487—, pp 31-48) **Solar simulators and indoor testing.** Gillett, W.B. (University Coll., Cardiff, Wales). 1977.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

In Testing of solar collectors and systems.

Thermal performance testing of collectors by indoor loss measurement and individual component property measurement is discussed with reference to the research programs being carried out by the International Energy Agency and the European Commission. A summary of the considerations involved in the design of a solar simulator is presented with special reference to the new facility under construction at Cardiff.

7790 (CONF-770487—, pp 49-69) **Joint solar collector testing programme of the European Community.** Aranovitch, E. (Joint Research Centre, Ispra, Italy). 1977.

From Conference on the testing of solar collectors and systems; London, UK (Apr 1977).

In Testing of solar collectors and systems.

The European Community, acting upon a decision of the Council of Ministers, has implemented a Programme on Solar Energy, which covers most of the areas of possible applications for our European climates. In this Programme the preparation of common test procedures for the evaluation of the performance of solar collectors has been considered of importance for various reasons. First there is an urgent need to put some order in a field where over-enthusiasm is not lacking. Collectors of inferior quality have appeared in some cases announcing inflated performances. The Programme of the European Community on collector testing can be divided into two parts: an "indirect action" which consists of national activities partially financed by the Commission and a "direct action" which consists of specific activities carried out by the Joint Research Centre at Ispra, Italy. Some examples of these activites are illustrated. Eighteen European laboratories or institutes (plus the JRC) are participating in the indirect action which is based mainly on round-robin testing of different types of collectors (see list in appendix).

7791 (CONF-770953—) **Solar concentrating collectors.** (Georgia Inst. of Tech., Atlanta (USA). Coll. of Engineering). 1977. Contract EG-77-G-05-5488. 689p. Dep. NTIS, PC A99/MF A01.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

Separate abstracts were prepared for 63 of the 72 papers presented. Nine papers were previously abstracted and can be found in the report number index under report number CONF-770953. (WHK)

7792 (CONF-770953—, pp 1.1-1.7) **Opening address.** Marvin, H.H. (Energy Research and Development Administration, Washington, DC). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The 1977 and 1978 federal solar budgets are briefly discussed, and the establishment and structure of the US Department of Energy are briefly described. (WHK)

7793 (CONF-770953—, pp 1.9-1.18) **Overview of DOE R and D program on concentrating collectors for solar thermal power applications.** Rannels, J.E. (Dept. of Energy, Washington, DC). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Some of the DOE R and D projects on concentrating collectors are reviewed including fixed mirror collectors, compound parabolic collectors, SLATS fixed receiver collectors, parabolic trough collectors, and parabolic dish collectors. (WHK)

7794 (CONF-770953—, pp 1.25-1.36) **Overview of the ERDA photovoltaic concentrator project.** Edenburn, M.W.; Schueler, D.G.; Burgess, E.L. (Sandia Labs., Albuquerque, NM). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

As the manager of ERDA's Photovoltaic Concentrator Development Project, Sandia Laboratories is pursuing development of low cost photovoltaic power by taking advantage of sunlight concentrators which replace high cost photovoltaic cells with lower cost reflective or refractive optical surfaces. The project includes developing solar cells which are designed for high solar intensity applications; finding and developing promising concentrator concepts; developing components for use in concentrators such as reflective and refractive optical devices, cell encapsulants, cell cooling mechanisms, and low cost sun tracking structures; testing and evaluating arrays and array components; studying various aspects of photovoltaic concentrators such as the effects of nonuniform illumination, shading, cell temperature gradients and cell cooling; developing manufacturing techniques for large scale array production; and procuring full-sized arrays for array tests and application experiments. A number of concentrator designs are presently being developed. These include compound parabolic concentrators at Argonne National Laboratories, a lightweight, reflective-film parabolic dish concentrator at Boeing Engineering, a Fresnel lens equatorial tracking concentrator at RCA, a parabolic trough concept at Spectrolab, a modular Fresnel lens array at Martin Marietta, and a Fresnel lens array at Sandia.

7795 (CONF-770953—, pp 1.37-1.44) **Concentrating collector applications in the DOE agricultural and industrial process heat program.** Greyerbiehl, J.M. (Dept. of Energy, Washington, DC). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Several demonstration projects of agricultural and industrial solar process heat are briefly described. Solar grain drying, solar process heat for textile dying and concrete block curing, and solar water heating for can washing at a Campbell Soup Company are discussed. (WHK)

7796 (CONF-770953—, pp 2.1-2.10) **Acurex cylindrical parabolic solar collector.** Muller, T.K. (Acurex Corp., Mountain View, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Acurex Corporation has designed and currently manufactures a parabolic trough, concentrating solar collector of the single-axis tracking type. This system has eight modules, each with a 6- x 10-foot aperture coupled torsionally to a common rotational axis. Each row of eight modules is positioned with the rotational axis oriented either east-west or north-south and tracking horizon-to-horizon. The collectors are designed to heat water, transfer oils, and other fluids to temperatures in the range of 140 to 600°F. Operation at these temperatures is required for the following applications: process hot water and steam, space heating, single- and two-stage absorption cooling and refrigeration, drying operations, and solar thermal and photovoltaic power generation.

7797 (CONF-770953—, pp 2.11-2.14) **Hexcel parabolic trough concentrator.** Branch, G.P. (Hexcel Corp., Dublin, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The solar-tracking parabolic trough collector with honeycomb sandwich construction manufactured by the Hexcel Corporation is described. (WHK)

7798 (CONF-770953—, pp 2.15-2.27) **Development and performance of the DEL concentrating solar energy collectors.** Goranson, G.G. (DEL Manufacturing Co., Monterey Park, CA); Riise, H.N.; Eldridge, B.G. 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The DEL parabolic trough concentrating collectors have been designed for high optical and thermodynamic performance and low cost in manufacturing, installation, operation and maintenance. The evolution of the unique DEL collector design is described relative to system considerations in space heating and cooling, industrial process heat, agriculture and power generation.

7799 (CONF-770953—, pp 2.29-2.39) **SLATS line focus solar collector.** Davison, J.H.; Wendt, A.J. (Suntec Systems, Inc., Lakeville, MN). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

SLATS (Solar Linear Array Thermal System) is a high concentration (40 : 1) solar collector with single axis tracking. It is composed of planar modules containing 10 one-foot-wide reflectors in which all reflectors are focused on a stationary, linear, overhead receiver. Each reflector concentrates reflected energy by a factor of 4 : 1 or more. These modules, depending upon the quantity of heat required and the site, may be connected in series forming rows 200 feet and more in length. SLATS is controlled electronically by an automatic closed loop servo system. The electronic control will automatically start operation each morning and end operation each evening. It also provides for shut-down in the event of cloud cover, over-temperature and power failure. SLATS can deliver thermal energy at high temperature with efficiencies exceeding 60%. This is obtained by use of high quality mirrors, an insulated receiver or heat absorber and controlled, real-time sun tracking. One SLATS has been in operation for more than a year. Other modules have been assembled, under ERDA contract, for evaluation at intermediate-to-high temperatures. In addition, Suntec is currently installing a 2800-square-foot collector field for the Sandia Laboratory, small scale, total energy system and is under contract to deliver a 10,000-square-foot collector field for the U.S. Fish and Wildlife Research Laboratory. Other orders are imminent in a variety of applications.

7800 (CONF-770953—, pp 2.41-2.49) **Development and evaluation of a medium temperature concentrating collector.** Gupta, B.P. (Honeywell Inc., Minneapolis). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A cylindrical parabolic solar collector was designed and fabricated and is undergoing tests to obtain performance data at operating temperatures up to 400°F. The concentrating collector is designed to track the apparent motion of the sun in one axis. The tracking axis can be aligned in any orientation, as the design allows for 270° of rotation during the day. The concentrator consists of one-half of a parabola reflecting the sunlight onto a cylindrical absorber tube. The parabolic structure is of a honeycomb sandwich construction to combine high strength and stiffness with light weight. The selectively coated absorber tube is insulated within a metal housing with a high transmittance glass window forming the receiver aperture. The receiver and the concentrator are arranged such that the receiver does not block any part of the concentrator aperture. The modular construction in 20-foot lengths allows convenient collector row lengths up to 120 feet with a compatible motor/gearbox drive mounted in the middle of the row. The design allows stowage of the collector in a low profile and low drag position with the mirror facing down to enhance the life of the second surface aluminized acrylic reflective material. Simulation analysis results of the thermal loss from the receiver and the overall collector efficiencies are presented. The results of the experimental evaluation with pressurized water as the heat transfer fluid is also presented. The collector tests with Therminol 44 as the working fluid are in progress. This collector design will be used in different lengths for ERDA demonstrations in heating and cooling and process heat applications and also on the Honeywell General Offices building HVAC system.

7801 (CONF-770953—, pp 2.51-2.55) **Seasonal daily thermal energy output of the Itek solar collector.** Goralnick, N.S. (Itek Corp., Lexington, MA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Measurements of overall efficiency as a function of temperature have been made on a demonstration tracking segmented mirror

collector system. The results are given based on local noon operation with peak solar insolation available. The approach to determine the seasonal daily thermal energy output of the Itek Solar Collector utilizing insolation data from Sandia Laboratories is described. The technique used to arrive at the thermal energy output is first to determine the "effective width" of the collector as a function of elevation angle from the local latitude reference. The second step is to determine the "effective length" of the collector as a function of time of day, including end losses and cosine effects. Thirdly, the effective width (after converting to time of day for the four seasons) is combined with the effective length to yield "effective area." Next, the local solar insolation data times the collector aperture is used with the effective area curves to produce curves of daily solar seasonal power available for conversion to thermal power. Finally, these curves are integrated to establish the seasonal daily solar energy available for conversion to thermal energy. The solar energy values are multiplied by the efficiency based on measurements made on Itek's demonstration solar collector, to arrive at the seasonal daily thermal energy output (corresponding to a 200-square-meter collector aperture area).

7802 (CONF-770953—, pp 2.57-2.60) **Fresnel lens concentrating collector.** Claxton, R.J. (Northrup, Inc., Hutchins, TX). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The Northrup Concentrating Collector is a polar axis collector with equatorial tracking capability. The collector consists of a steel trough housing with a black chrome plated, copper absorber tube and a curved fresnel lens. Applications include heating, cooling, and domestic hot water; some of which are among the largest solar installations in the world. Recent engineering advancements have overcome some of the initial difficulties with the sun tracking system, and all installations are being upgraded with this new hardware. Meanwhile, research and development continues on the next generation collector. Major advances to be expected include a more efficient fresnel lens and an advanced receiver assembly.

7803 (CONF-770953—, pp 2.61-2.69) **Solar concentration by curved-base Fresnel lenses.** Cosby, R.M. (Ball State Univ., Muncie, IN). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The solar concentration performance of idealized curved-base, line-focusing Fresnel lenses is analyzed. A simple optical model for studying the solar performance effects of base curvature, lens f-number, small transverse tracking errors, and slight defocusing is described. Computer-generated example data for a lens with a 36 inch (91.4 cm) wide aperture indicate substantial improvements occur in solar concentration characteristics over the flat lens case when base curvature is introduced. Required target receiver widths are significantly reduced. Performance sensitivities to small transverse tracking deviations (0 to 2°) improve when the lens base is curved, in contrast to the increased degradation of image profile characteristics with slight defocusing (+-2% of the focal length). The computed lens solar transmission is generally in the 85 to 88% range. In comparison to an f/1.0 flat lens, selection of a curved base Fresnel lens with 0.8 equal to or less than f-number $<$ 1.0 and curvature radius equal to or less than focal length is predicted to improve the overall solar optical performance while decreasing support structure and tracking system requirements.

7804 (CONF-770953—, pp 2.71-2.77) **Performance characteristics of a 1.8 by 3.7 meter Fresnel lens solar concentrator.** Hastings, L.J.; Allums, S.L. (George C. Marshall Space Flight Center, Huntsville, AL). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Line-focusing acrylic Fresnel lenses with application potential in the 200 to 370°C range are being analytically and experimentally investigated. The measured solar concentration characteristics of a 1.8 by 3.7 m lens and its utilization in a solar collection mode are summarized. A peak concentration ratio of 64 with 90% of the transmitted energy focused into a 5 cm width was achieved and demonstrated the feasibility of the Fresnel lens solar concentrator concept.

7805 (CONF-770953—, pp 2.79-2.84) **Radiation-cavity solar collector for high-temperature applications.** Antoniak, Z.I.; Palmer, H.B. (Pennsylvania State Univ., University Park). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A 1.5 m long experimental model of a previously-proposed high-temperature solar concentrator-collector in which argon is employed as a working fluid was studied. The effect of using a selective absorber in place of the graphite absorber reported on earlier was investigated. No measurable gain in efficiency was observed. A computer model of this system which takes into account most of the influential variables has been formulated. It yields temperature profiles that normally agree with the experimental data at all axial positions within ca. 10°C. This good agreement permits the formulation of a second computer model, of the full-scale device, with confidence. The effect of various parameters has been investigated in an optimization study of the full-scale collector.

7806 (CONF-770953—, pp 2.85-2.91) **Hybrid concentrating mechanical tracking collectors in mainframes typical of flat plate collectors: the best of several technologies aimed at solar cooling reliability (an ongoing project of).** Brent, C.R. (Univ. of Southern Mississippi, Hattiesburg). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Random direct beam solar radiation measurements made over the past three years confirm the distinctly flatter power curve available to tracking collectors compared to direct beam radiation falling on a fixed collector. Knowing that an economic breakthrough in solar cooling would have to be made in order for maximum solar utilization to occur in the South, the author combined the protective and insulating properties of mainframes typical of flat plate collectors with tracking (+-4°) miniature concentrating troughs in an attempt to optimize a high temperature solar collector capable of powering an absorption chiller at 99°C. Prototype testing provided an efficiency near 20% at this temperature. Upgrading of reflectors, glazing, and absorber surface should provide higher efficiencies. Collector costs are somewhat high at $178/m^2$ but capital recovery calculations show that a system cost of $9,500 can be amortized against fuel savings of $600 per year in 1978 within a pay-back period of ten years.

7807 (CONF-770953—, pp 2.93-2.102) **Results of development of linear parabolic trough.** Hutchison, G. (Solar Kinetics, Inc., Dallas). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

After more than two years of development and testing Solar Kinetics, Inc. has completed the T-500 Solar Collector. Initial design considerations included short focal length for reasonable mirror accuracy requirements, monocoque construction for maximum strength per weight ratio and angular misalignment compensation for minimum maintenance and installation expense. Black chrome was chosen for the selective surface and the receiver is insulated with pyrex glass, suspended on Silicone "O" rings. Hydraulics are used for tracking due to the many benefits which include superior tracking accuracy. Finally, testing was reduced to various performance curves.

7808 (CONF-770953—, pp 2.103-2.115) **An inflated cylindrical concentrator for producing industrial process heat.** Gerich, J.W. (Lawrence Livermore Lab., CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The use of industrial process heat below 170°C accounts for 5% of this country's total energy consumption. A concentrating solar collector is being developed to produce hot water and steam in this temperature range. The collector structure consists mainly of an inflated thin film plastic cylinder which is clear on the upper portion and is an aluminized reflector on the lower portion. The reflector concentrates sunlight on a receiver tube which is jacketed with a heat transfer suppressing thin film plastic cylinder. Because of its simplicity, it is believed this collector will be cost effective relative to fossil fuels such as oil at $15/barrel. Computer codes were written to analyze the optical and thermal properties of this collector. Results indicate that weekly tilting of the collector provides over 90% of the energy available from continuous tracking. A selective surface on the receiver tube ($\alpha = 0.84$, epsilon $= 0.20$) increases the useful energy gain by over a factor of five at 170°C. The stagnation temperature at the outer receiver tube surface is calculated to be below 350°C. Combining calculated optical and thermal efficiencies gives an overall collector efficiency of 20% for 170°C operation. This is based on an aperture of the full diameter times the length and on beam radiation. The first experimental collectors are being constructed to verify our computer code studies. These units have an outer diameter of one meter and are four meters long.

7809 (CONF-770953—, pp 3.1-3.8) **Fixed mirror solar concentrator.** Russell, J.L. Jr.; Schuster, J.R. (General Atomic Co., San Diego, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The General Atomic Company (GA) fixed mirror solar concentrator (FMSC) employs a fixed mirror trough that produces a sharp line focus regardless of sun position. The heat receiver, which employs a compound parabolic (Winston) secondary concentrator, is moved in a circular arc to track the focal line. General Atomic is fabricating FMSC modules of precast concrete and glass mirrors to supply a 260 m^2 (2800 ft^2) mirror field to Sandia Laboratories, under Contract 05-4569, for their Solar Total Energy Demonstration Facility. These modules will be constructed on site at Sandia using local labor. The combination of concrete substrate and glass mirrors yields a rugged, low-maintenance concentrator that has good potential for low-cost, high-volume, on-site construction. Use of a secondary concentrator makes possible the design of a practical FMSC to efficiently generate steam at modern steam plant operating conditions. Plans are under way at GA to measure heat losses from various high-temperature heat receivers and to operate a small solar hardware demonstration unit using the heat-transfer salt Hitec.

7810 (CONF-770953—, pp 3.9-3.16) **Design and predicted performance of Scientific-Atlanta's fixed faceted mirror concentrator.** Shelton, S.V.; Blackshaw, A.; Hutchins, S.F. (Scientific-Atlanta, Inc.). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A high volume manufacturing design has been developed by Scientific-Atlanta, Inc. for a linear east-west fixed faceted mirror solar concentrator. This concept utilizes fixed east-west flat mirror slats oriented around a circular arc such that the resulting focal line is an east-west linear band in front of the mirror slats which moves north-south or another circular arc. Both the arc on which the mirrors are located and the arc on which the focal band moves are on a common circle lying in a vertical plane. The maximum energy is generally collected annually if the normal to the aperture is tilted from the vertical toward the equator an amount equal to the latitude of its location. The developed design incorporates 28 rear silvered mirror slats each of which are 7.3 cm wide and spaced over 105° of a 127 cm radius arc. The total collector aperture width is 2 meters. The east-west aperture length can be any integral number of 3 meters. The moving receiver at the focal band incorporates a secondary trapezoidal concentrator (groove type) with a 2 to 1 concentration ratio. Its aperture is 12.7 cm wide concentrating onto a 6.4 cm wide flat absorber surface. The mechanical design utilizes die stamped and roll formed galvanized sheet metal parts for the mirror slat supporting structure. This insures low manufacturing costs with the necessary accuracy of mirror location. The mirror slats are held onto the sheet metal brackets by spring clips. The receiver is made up of a flat single glazed absorber consisting of multiple side-by-side tubes and coated with black chrome. The sides and back of the absorber are insulated.

7811 (CONF-770953—, pp 3.37.3.44) **Design considerations for a stationary concentrating collector.** Patton, R. (Chamberlain Manufacturing Corp., Waterloo, IA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Several configurations of Compound Parabolic Concentrators (CPC) have been evaluated for non-evacuated receiver intermediate temperature use. Collector models were constructed and tested for overall heat loss coefficients. The model variables included concentration ratio and absorber sizes. A mathematical model of the various reflector/absorber configuration was integrated with a ray trace program to evaluate the average number of reflections and the actual percentage of the incident insolation that intercepts the absorber for incidence angles from 0 to 34°. These results were incorporated into a computer model with hourly insolation data to predict monthly and annual gains for each configuration. The most effective design was chosen and a prototype solar collector has been designed. The major components of the optimum design have been fabricated and a prototype collector is being built to verify the performance prediction.

7812 (CONF-770953—, pp 3.45-3.54) **Design of fixed evacuated concentrating collectors for operation at 80° and 200°C.** Garrison, J.D. (San Diego State Univ., CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Space heat, hot water, air conditioning and process steam utilize more than 40% of U.S. energy consumption. These uses provide the greatest opportunity for solar energy to contribute significantly to the U.S. and world energy needs. In order to compete economically with other energy sources for these uses and also achieve the higher operating temperatures required for air conditioning and process steam (up to approximately 200°C), a solar collector must have low energy loss and low cost. Low loss requires vacuum to eliminate conduction and convection losses, and concentration onto a selective absorber to minimize radiation loss. Optimum concentration, or minimum ratio of absorbing surface area to collecting area, requires Winston concentration. The apparent motion of the sun indicates the use of cylindrical concentration with axis east-west. A series of arguments leading to optimum performance at near minimum cost indicate the collector should be of all glass tubular construction. A mirror coating on side and bottom inside surfaces provides concentration onto an internal glass tube coated with selective absorber. The window is only slightly convex to withstand atmospheric pressure while keeping reflection losses low. Heat transfer calculations, which are used to minimize losses, help fix the collector length and width. Radiation collection calculations determine the acceptance angle and other parameters.

7813 (CONF-770953—, pp 3.55-3.60) **Fixed concentrating flatplate collectors for heating and hot water applications.** Espy, P.N. (George C. Marshall Space Flight Center, Huntsville, AL). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

An alternative to simple flatplate collector use for solar heating and hot water systems is a fixed concentrating collector utilizing low cost flatplate collectors. The argument against the use of low efficiency collectors for winter collecting temperatures of about 70°C (158°F) is met from economic and technical considerations. It can be shown that the least expensive collectors augmented by single or double faceted reflectors perform at high efficiency and at a low total collector array cost. Additionally the system operating requirements for summer for domestic hot water at about 60°C (140°F) are adequately met. The design proposed has a reflector oriented at a right angle to the collector. The results of this design approach is to provide a concentration ratio of about 1.5 during the winter season, and a concentration ratio of 1.0 during the midsummer period. Winter performance of an inexpensive and relatively inefficient collector may thus be elevated to more than twice the collected energy of conventional configurations; the summer efficiency need only be that which is required for meeting hot water heat loads. The overall system may thus be seen to better match the load requirement of heating and hot water applications.

7814 (CONF-770953—, pp 3.61-3.70) **Crosbyton solar power project: fixed spherical mirror/tracking receiver.** Reichert, J.D. (Texas Tech Univ., Lubbock). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The Crosbyton Solar Power Project at Texas Tech University deals with the Solar Gridiron concept, often called the FMDF (Fixed Mirror-Distributed Focus) concept. Basically, the concept involves the use of large spherical segment mirrors fixed in position with the symmetry axis declined about 15° south of vertical. The support for the mirror involves excavation near the south lip and space frame near the north rim. A conical receiver, typically operating with a water-steam cycle, is the tracking element. The tracking requirement is for the receiver cone symmetry axis to lie, at all times, on the line determined by the center of the sun and the center of curvature of the spherical segment. The project, funded by ERDA, has been under way for 12 months and a conceptual design for a nominal 5 MW(e) solar-thermal-electric system has been developed, matched to the load and climatic conditions of Crosbyton, Texas. The Solar Gridiron concept offers reasonable high temperature performance at relatively low cost and there is some indication that such systems may be cost effective in the near term market.

7815 (CONF-770953—, pp 3.71-3.85) **Radiative characteristics of non-tracking moderately concentrating solar energy collectors.** Bannerot, R.B. (Univ. of Houston, TX). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The ideal (geometric) and effective (actual) concentration ratios are used to compare the radiative performances of various booster mirror configurations and non-tracking, East-West aligned grooved collector designs. The groove designs are represented by various side wall shapes, including a single straight facet (trapezoidal), a double facet, and a range of curved wall designs including the Compound Parabolic Concentrator or Winston Collector. The results of the comparison indicate that a wide range of performance is possible. In particular, the higher the ideal concentration ratio, the smaller the acceptance angle of the collector. This in turn indicates the frequency of tilt adjustments and the usefulness of non-direct insolation. Designs with the highest effective concentration ratios are usually impractical due to the amount of reflector area required. Only a small performance degradation occurs when a significant amount of reflector is removed. In general the single facet wall collector is limited to practical concentration ratios up to about 2.0. The two facet designs extend this to about 2.7. Additional facets continually increase the concentration ratio (as the acceptance angle

decreases) until the performance of the Compound Parabolic Concentrator is attained. The maximum practical concentration ratio without tracking is around six. 44 references.

7816 (CONF-770953—, pp 3.87-3.91) **Design considerations for solar radiation concentrators.** Mather, G.R. Jr.; Beekley, D.C. (Owens-Illinois, Inc., Toledo). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The character of insolation as to beam and diffuse components must enter into the design considerations for proper evaluation of a concentrating surface. Various aspects of this problem are discussed in terms of tests and evaluation of concentrating surfaces. The surfaces are shown to provide various degrees of collector performance enhancement both for the beam and diffuse components of insolation. Modest concentration ratios are achieved by the use of these non-imaging optical surfaces but collector performance is increased regardless of the character of the insolation. Problems concerning the manufacture and durability of the surfaces are discussed.

7817 (CONF-770953—, pp 3.93-3.101) **Fixed, moderately concentrating collector with reversible asymmetric vee-trough and vacuum tube receiver.** Selcuk, M.K. (Jet Propulsion Lab., Pasadena, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A vacuum tube receiver combined with an asymmetrical vee-trough is being developed as an efficient solar heat collector for a range of about 100 to 200°C. An improvement in the efficiency of the vacuum tube receiver and a reduction in collector cost result with the use of the vee-trough reflector. A triangular sectioned, flat surfaced reflector, whose axis is laid in the East-West direction, is reversed 180° on the equinoxes. The collector is tilted an angle which equals the latitude. Thus, a concentration ratio of about two is obtained for eight hours daily and year-round operation. A vacuum tube receiver placed at the bottom of the vee-trough collects solar heat most efficiently since convection is completely eliminated; radiation losses are reduced by use of selective coatings on the absorber, and conduction losses can be minimized with a well insulated manifolding system. Steady-state performance based on the absorber area as well as day long efficiency data are presented. A test bed for experimental evaluation of a fixed solar collector which combines an evacuated glass tube solar receiver with a flat plate/black chrome plated copper absorber and an asymmetric vee-trough concentrator was designed and constructed. Analytical predictions of thermal performance were compared with test data acquired for a bare vacuum tube receiver and receiver tubes with Alzak aluminum, aluminized FEP Teflon film laminated sheet metal and second surface ordinary mirror reflectors. Test results and system economics are discussed.

7818 (CONF-770953—, pp 3.103-3.108) **Optical performance of the compound trapezoidal collector (an optimized non-focusing concentrating collector).** Truong, H.V.; Villanueva, J. (Florida Atlantic Univ., Boca Raton). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

This paper is concerned with the theoretical evaluation of the operating characteristics of an optimized non-focusing "Compound Trapezoidal Collector." A "Compound Trapezoidal Collector" consists of two successive trapezoidal grooves the dimensions of which are optimized to accept all the solar insolation impinging upon it when the sun's rays are directed along the optical axis of the collector. Previous results on computer simulation of this collector indicate that theoretical concentration ratios as high as 5 can be achieved, however, a daily average concentration ratio of 3.5 can be obtained with this optimal geometry. The computer simulations presented include the optical performance of the CTC for various reflective wall reflectivities and receiver surface absorptivities. Only direct solar radiation has been considered in the theoretical estimation so far. A more complicated computer simulation that includes diffuse solar radiation collection is now underway utilizing a Monte Carlo technique. Predicted results are verified by direct testing of a prototype collector which was constructed to receive an evacuated tube at the target.

7819 (CONF-770953—, pp 3.109-3.113) **General model for predicting the performance characteristics of planar concentrating systems.** Edgecombe, A.L.; Clausing, A.M. (Univ. of Illinois, Urbana). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The specular reflector enhancement of flat plate solar collectors is analyzed in this study. A mathematical model is developed and two key geometrical parameters are introduced in the analysis of the spatially averaged energy flux over the collector surface. The model allows these parameters to be determined as a function of the collector size and tilt, the reflector size and tilt, and the position of the sun. The key parameters, when time averaged over a period of interest, yield a relative measure of the direct beam component and the specularly reflected component of the total energy flux during the given period. The relative values of these two flux components are used in optimizing the reflector-collector system. Data gathered by computer simulation is presented as an example of determining an optimum system with respect to one of the system variables.

7820 (CONF-770953—, pp 3.115-3.121) **New design for an efficient low concentrating solar collector.** Eldifrawi, A.A. (Irvin Industries, Inc., Lexington, KY). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A design of a low concentrating collector has been developed. The design incorporates two reflectors, one mounted above and the other mounted in front of a flat plate collector. This assembly is enclosed inside an air-supported transparent membrane structure. Besides the increase in solar insolation received by the collector absorber due to the reflectors, the temperature around the flat plate collectors increases either due to the greenhouse effect or by utilizing the building exhaust air in supporting the structure. This results in a significant increase in the system's efficiency. The membrane inflated structure provides protection against weather conditions and the structural integrity of the system. It is possible, therefore, to use an inexpensive and thinner glazing material for the enclosed flat plate collectors. The preliminary analysis indicated that the flat plate collector's performance, when incorporated inside the structure, would increase over 100% under extreme cold weather. An output of 200°F, required for solar absorption air conditioning, is possible at a reasonable efficiency. The economic analysis of the utilization of this concentrator indicates that it would be cost effective.

7821 (CONF-770953—, pp 3.123-3.132) **Novel concentrating solar collector and receiver system.** Antrim, W.D. Jr. (American Science and Engineering, Inc., Cambridge, MA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A concentrating solar collector and receiver system new to the subject literature is described. The collector lens is a right circular cylinder comprised of a transparent tube filled with water. A row of such cylinders would face South, vertical or inclined to receive optimum sun for the latitude. Energy is concentrated onto focal lines which are a short distance aft of the cylinders. Thus, in this passive system the vertical focal position lines sweep from West to East behind the cylinders onto a pipe-organ-like row of thermally separate receiver pipes which take a sequential focal position as the sun sweeps its path. The water in the collecting lenses will be the system entry and thus will receive preheating to moderate reflection and transmission losses. The plumbing system in the receiver pipes will employ automatic rationing to render inoperative all but the ones in the focal position. It is anticipated that the system lends itself to very economical production.

7822 (CONF-770953—, pp 3.133-3.143) **Pyramidal optics solar concentrating system.** Wormser, E.M. (Wormser Scientific Corp., Stamford, CT). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A low gain concentrating system, the Pyramidal Optics Solar Concentrating System is described. The system has been incorporated in a model home of 1,400 sq ft heated area near Rehoboth, Delaware. The performance of the system through the winter of 1976-1977 is briefly described.

7823 (CONF-770953—, pp 4.17-4.19) **Concentrating collectors for thermophotovoltaic converters.** Bracewell, R.N.; Price, K.M.; Swanson, R.M. (Stanford Univ., CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

An assessment of the feasibility of a solar-electric thermophotovoltaic (TPV) system is being carried out at Stanford University. In the TPV system, sunlight reflects from a paraboloidal concentrator and reaches the TPV converter located at the focus. The concentrated sunlight enters the converter through a window and receives slight additional concentration from a CPC secondary concentrator. The sunlight then passes through a throat into an evacuated cavity and heats a refractory radiator. A photovoltaic cell faces

the radiator, receives incandescent radiation from it, and converts this radiation into electricity. Project status is summarized.

7824 (CONF-770953—, pp 4.21-4.24) **Pressure Stabilized Solar Collector (PSSC).** Brantley, L.W. Jr. (George C. Marshall Space Flight Center, Huntsville, AL). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Presented is a concentrating, two-axis tracking, spheroidal collector designed to minimize the cost of the tracking system and the reflector. The cavity absorber has been designed to minimize the tracking and reflector surface accuracy requirements while maintaining high performance efficiency. Working fluid temperatures of 200 to 1000°F are achievable at efficiencies of 50 to 70% of the direct solar radiation at a cost projected in mass production to be as low as $5/ft^2 for units 25 to 50 feet in diameter.

7825 (CONF-770953—, pp 4.33-4.36) **Parabolic collector for total energy systems application.** Levine, A.L.; Paradis, L.R.; Truesdale, K.L. (Raytheon Co., Bedford, MA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The Raytheon Company is participating in the ERDA/Sandia Laboratories total energy systems development program by designing and fabricating a parabolic, point concentrator solar collector. The point concentrator designed and under construction is a toric parabola 6.7 m diameter, with an effective aperture of 35 m^2. Azimuth and elevation drive systems are computer controlled and provide maximum aperture utilization over the course of the year. Mirrors are curved glass, hard mounted on an aluminum substructure, concentrating the solar energy into a cavity absorber located on the collector optical axis.

7826 (CONF-770953—, pp 4.37-4.45) **Evaluation of a faceted mirror solar concentrator.** Rogers, W.; Borton, D. (Rensselaer Polytechnic Inst., Troy, NY). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

During 1976, a 33 square meter (360 square foot) solar concentrator was constructed at the NYSERDA research station in upstate New York. It was designed as a research tool to evaluate the performance of this heliostat design and of receivers at its focus as well as to ascertain characteristics of insolation at the site. The 9 meter (30 feet) high structure including reflector banks and focal area pivots on two bearings on an east west axis. A motor powered winch controlled by a sun-sensing feedback system enables the collector to follow altitude changes of the sun. Two banks of mirrors each contain 27 columns upon which are mounted fifteen 20 cm (8 inch) square second surface flat mirrors. These columns are linked together and rotate so that the reflections of the sun from all the mirrors remain at the focus as the sun moves across the sky. Overall efficiencies (normal incidence radiation on reflector area vs. heat delivered by fluid) from .50 to .73 have been recorded for many weather and operating conditions. An average specular reflectivity of .79 has been measured for the mirrors exposed to weather for 1½ years. A receiver efficiency (heat delivered by fluid/radiant energy at receiver aperture) of 94% has been obtained on a clear summer day using an automotive radiator and a 50°C temperature rise.

7827 (CONF-770953—, pp 5.1-5.4) **Reflective materials for solar systems.** Munoz, F.; Gonzalez, A.; Almanza, R. (National Univ. of Mexico, Mexico City). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

One important problem in Mexico is to get good reflective materials for solar energy applications. Different reflective materials have been developed at the Institute of Engineering in order to build good mirrors. These are the following: (a) Second aluminized surface has been evaporated on acrylic, afterwards covered with paint in order to protect the aluminum; reflectance of 0.8 was measured in these mirrors. (b) Small aluminum sheet samples of very high purity (99.8%) have been electropolished using the following electropolishing solutions: (1) fluoboric acid; (2) sulfuric acid, orthophosphoric acid and chromic acid; (3) perchloric acid and acetic anhydride; and (4) sodium hydroxide and tribasic sodium phosphate. All these solutions contain a defined quantity of water. The reflectance of these samples was found to be of the order of 0.7. (c) Vacuum-evaporated aluminum into stainless-steel sheets, afterwards covered with acrylic, transparent paints or anodized films; produced around 0.7 reflectances. (d) Polished brass sheets are plated in chrome and nickel baths; 0.6 reflectances were obtained. Reflectances were measured with a laser ray and incidence was about 5° from the vertical.

7828 (CONF-770953—, pp 5.15-5.31) **Weather-testing of solar utilization materials.** Gilligan, J.E.; Brzuskiewicz, J.; Gaumer, S.J. (IIT Research Inst., Chicago). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A program of research and experimental testing is described in which the optical and mechanical performance of materials for use in solar energy utilization devices is determined before and after exposure to outdoor weathering tests. Materials which are currently in use and others which are being considered or developed for these applications are being exposed to outdoor weathering in Phoenix (Ariz.), Miami (Fla.), and Chicago (Ill.). The results of these tests, primarily the effects of outdoor exposure on optical and physical properties, will ultimately be compiled in a handbook, along with cost, availability and other pertinent information.

7829 (CONF-770953—, pp 5.33-5.43) **Cast acrylic Fresnel lens solar concentrator.** Nixon, G. (Swedlow, Inc., Garden Grove, CA). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A description of Fresnel lens solar concentrators prepared for solar thermal and photovoltaic applications is presented with arguments for this refracting method of concentration compared with that obtained by reflection. Acrylic material used in a casting process has been utilized successfully by Swedlow, Inc. in producing such Fresnel lenses, and arguments for both this selected material and the noted process are delineated. A status report of lens production and field experiences is made along with lens price projections. Design techniques, performance characteristics, and the next generation of Fresnel lens development are described.

7830 (CONF-770953—, pp 5.45-5.53) **Anticlastic reflecting concentrators.** Cowman, C.D. (3M Co., St. Paul); Shepherd, J.P.G. 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A low cost reflecting concentrator, with potential applications for solar energy collection, has been developed (U.S. Pat. No. 4,035,064). The optics of reflecting anticlastic, e.g., (parabolic hyperloid) surfaces are discussed with reference to two practical examples: a plane mirror subjected to a twisting deformation and an edge defined minimum area reflecting surface. Results from a computer ray tracing study of some minimum area surfaces are presented with preliminary experimental data.

7831 (CONF-770953—, pp 5.121-5.128) **Flood-lamp shaped concentrating collectors for solar-thermal or total-solar applications.** Grimmer, D.P. (Los Alamos Scientific Lab., NM). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

A flood-lamp sized paraboloidal-shaped concentrating collector that is currently under study at LASL is described. These glass collectors are physical vapor deposited (PVD) aluminized on their inside reflecting surfaces just like a flood lamp. However, rather than a filament assembly at the focus, there is an absorber tube upon which the incoming solar radiation is concentrated.

7832 (CONF-770953—, pp 6.1-6.8) **Application of ASHRAE Standard 93-77 to concentrating collectors.** Hill, J.E.; Jenkins, J.P. (National Bureau of Standards, Washington, DC). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The American Society of Heating, Refrigerating, and Air Conditioning Engineers, (ASHRAE) has recently adopted ASHRAE Standard 93-77 for testing and rating of solar collectors based on thermal performance. Four separate tests are required to be conducted. The tests are explained, and their adaptation for use with concentrating collectors is indicated.

7833 (CONF-770953—, pp 6.9-6.14) **Thermal efficiency test procedures and results for a cylindrical concentrating collector.** Thomas, W.C. (Virginia Polytechnic Inst. and State Univ., Blacksburg). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The applicability and limitations of established test standards for evaluating cylindrical concentrating (CC) collectors are examined. A CC solar collector manufactured by Martin Processing, Incorporated, is described. Differences between test procedures for CC and other collector designs are considered. Existing standards make no distinction between the "hour" angle and "acceptance"

angles as related to the incident angle. Since test results should provide information for determining day-long response, a new test procedure for the angular response tests is suggested. The efficiency of a CC collector is generally much more sensitive to the directional properties and magnitude of the scattered component of solar radiation. Results for the thermal efficiency and angular response under various environmental conditions are shown and compared with theory.

7834 (CONF-770953—, pp 6.19-6.30) **Concentrating collector testing at the Solar Engineering Test Module.** French, R.L.; Mooney, L.G.; McDowell, J.H.; Uselton, R.B. (American Technological Univ., Killeen, TX). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The Solar Engineering Test Module (SETM), a facility designed for testing concentrating collectors at intermediate heat-transfer fluid temperatures (< or = to 530°F) and pressures (< or = to 1050 psi), is operated by American Technological University (ATU) in support of the ATU/Fort Hood Solar Total Energy Military Large-Scale Experiment (LSE No. 1). Objectives include (1) data for verification of modeling techniques for predicting the amount of solar energy that can be collected at Fort Hood, Texas, and (2) information on concentrating collector operation, control, reliability, and cleaning requirements. The SETM consists of an instrumented loop for circulating water through the receiver of a 400-ft² Suntec Systems, Inc., SLATS/sup TM/ collector module which is a linear-focusing, segmented-reflector fixed-receiver collector. Measurements at the SETM include normal-incidence solar intensity, receiver inlet/outlet temperatures, and fluid flow rates and pressures. Data reduction and analysis includes consideration of solar intensities and the various optical, geometric, and thermodynamic factors which influence the collector performance. Preliminary results indicate a nominal efficiency of 40% for the SLATS collector with vee-entrant receiver that is presently installed at the SETM.

7835 (CONF-770953—, pp 8.35-8.45) **Survey of generic types of focusing collectors for large-scale applications.** Wachtler, W.J.; Price, J.H.; Henry, R.L.; Hale, B.L. (American Technological Univ., Killeen, TX). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The pertinent features and characteristics of focusing collectors are described, and their large-scale applicability is compared and evaluated from a generatic standpoint. The information provides a basis for the selection of a generic type of high-temperature focusing collector operating in the temperature range of 280 to 650°F. The data and information were obtained from a survey of a number of collector manufacturers. Five generic types of focusing collectors were surveyed: the parabolic trough, parabolic dish, linear-segmented array, fresnel lens, and fixed mirror. Generic types are discussed in terms of their optical and structural characteristics. The components considered include the concentrator, receiver, drive mechanism, pylons, and tracking device. Design considerations are given to the auxiliary components used, such as flexible hoses, couplings, insulation, and construction materials. The collectable energy is compared for both single-axis and two-axis tracking modes. Further, the collector field layout and orientation are discussed regarding annual performance and heat losses. Collector selection criteria are identified as well as methods for making predictions of both performance and cost. A summary of the significant findings is presented, which consists of the availability of each type of collector in terms of size, cost, production, and development.

7836 (CONF-770953—, pp 9.1-9.6) **Influence of circumsolar radiation on the performance of nonfocusing-concentrating collectors.** Kreith, F. (Solar Energy Research Inst., Golden, CO); Oswald, R.; Winston, R. 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

In previous studies of the thermal performance of compound parabolic collectors analytical models have been used which assumed that the all beam radiation emanates from the solar disc within a solid angle of thirty-two minutes and that the diffuse radiation is isotropically distributed around the aperture of the collector. Recent data collected at the University of California and in Europe indicate, however, that the diffuse radiation is not isotropic and it has a very distinct and pronounced circumsolar component. Whereas focusing collectors of the line or point focusing type can only make use of the radiation contained within the solar disc, distributed focusing collectors can also utilize diffuse radiation within the acceptance angle of a particular geometry. The thermal performance predicted on the basis of the idealized model which assumes isotropic diffuse radiation is compared with a more realistic model which considers the circumsolar radiation distribution. Also, a preliminary correlation for the distribution of circumsolar radiation applicable to various weather conditions is presented.

7837 (CONF-770953—, pp 9.15-9.23) **Econometric analysis of concentrators for solar cells.** Roy, A.S. (Inst. for Energy Analysis, Oak Ridge, TN). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

When concentrating collectors are used with photovoltaic solar cells, the cost of the generated electricity is controlled by the concentrator cost. This enables the use of highly efficient cells and collectors of high concentration ratios, thereby reducing both the cell and the non-cell cost components per unit generated electricity. A generalized model is formulated for correlating the electricity cost to the system parameters. The model enables the economic assessment of various concentrator-cell systems and the evaluation of the sensitivity of the cost of the produced electrical energy to various possible technological improvements. Optimization and the setting of a spectrum of target goals for cells and collectors are thus made possible. An example is included showing minimum generated electricity costs for particular concentration ratios (between 4 and 400) and other parameters.

7838 (CONF-770953—, pp 9.25-9.30) **Annual performance comparisons of parabolic trough and flat plate collectors based on measured insolation.** Treadwell, G.W.; Grandjean, N. (Sandia Labs., Albuquerque, NM). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Parabolic trough and flat plate non tracking collectors in various orientations have been analytically compared for annual performance capabilities at two locations and at various delivery temperatures. These comparisons have been made using hourly measured direct and total horizontal insolation and weather data. The comparisons indicate the parabolic trough will outperform the flat plate collector at delivery temperatures as low as 80°F. This results because the thermal losses are lower and the tracking of the sun more than compensates for the trough's inability to use the diffuse component of radiation. Current state-of-the-art designs have been used. It is likely that materials improvements can be made in both parabolic trough and flat plate collectors but not enough to significantly change the outcome. If anything, design and materials changes will increase the differences in performance. Performance data for other locations will be obtained as solar and weather data become available. Surveyed collector cost information will permit the cost of energy to be calculated.

7839 (CONF-770953—, pp 9.39-9.48) **Role of simulation in the development of solar-thermal energy conversion systems.** Schrenk, G.L. (Univ. of Pennsylvania, Philadelphia). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Research on the design of solar-thermal energy conversion systems in the early 1960's for space-power applications led to the development of a number of new analytical techniques--techniques that are useful in the design and analysis of the various terrestrial solar-thermal energy conversion systems currently being investigated. The primary uniqueness of these techniques is that they are based on the fundamental physical realizations that we have an extended finite-sized source and that the resultant radiation transfer must therefore be analyzed using cones, either infinitesimal or finite, rather than optical rays as the basic vehicle for energy transport. Utilizing the physical insights gained from these direct analytical methods, a comprehensive approach to the design, analysis, testing, and operational use of solar-thermal systems has been developed and is presented; it involves the use of simulation procedures wherein a delicate balance is achieved between mathematical simulation and actual laboratory simulation. These procedures are more than just another series of isolated mathematical models of idealized physical systems; they are a simulation philosophy that covers all aspects of the design, construction, testing, and operational use of the system. The computer codes, originally written as large FORTRAN IV programs, have recently been rewritten in APL on the APL-PLUS Scientific Time Sharing Corporation System. As a result, an extremely powerful and versatile interactive mathematical solar simulator has been created. APL-PLUS service is readily available on a nationwide basis; thus, it is quite easy for anyone, even with only limited programming experience, to utilize these existing APL routines.

7840 (CONF-770953—, pp 9.49-9.57) **Orientation studies for single axis concentrating collectors.** Jeter, S.; Craig, J.I.; Grems, E.G. (Georgia Inst. of Tech., Atlanta). 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

The useful heat gain of a linear single-axis concentrating solar collector is significantly affected by the orientation of the collector. The temporal distribution of the heat output, both diurnally and annually, and the integrated energy output vary with the direction of the collector axis. For a typical insolation sequence, a north to south orientation yields greater annual heat gain while an east to west orientation gives a flatter annual distribution. Selection of the best collector orientation depends on this distribution, the thermal capacitance of the system, and the load profile. These factors are considered in the definition of an economic criterion function which is then used to identify the optimum distribution of collectors among all possible orientations. A minimum value indicates a collector array optimized with respect to the characteristics of the load and the overall solar energy system.

7841 (DOE/NASA/CR—78153) **Test and analysis of a Northrup Collector Controller.** Scott, D.R.; Kissel, R.R.; Reid, H. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Jan 1978. Contract EX-76-A-29-1037. 24p. Dep. NTIS, PC A02/MF A01.

The collector controller is examined as a functioning control system that drives the Northrup collector from east to west to follow the Sun then back to the east at sundown in readiness for the next sunrise. The major components are examined separately with particular emphasis placed on an analysis of the electronic drive circuit. The collector is a concentrating collector using a Fresnel lens. Results are presented from hardware testing and analysis with recommended changes to improve the system.

7842 (DOE/NASA/CR—150505) **Thermal performance of Honeywell Double Covered Liquid Solar Collector.** Losey, R. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Nov 1977. Contract EX-76-A-29-1037. 19p. Dep. NTIS, PC A02/MF A01.

The test procedures and results obtained during an evaluation test program to determine the outdoor performance characteristics of the Honeywell liquid solar collector are presented. The program was based on the thermal evaluation of a Honeywell double covered liquid solar collection. Initial plans included the simultaneous testing of a single covered Honeywell collector. During the initial testing, the single covered collector failed due to leakage; thus, testing continued on the double covered collector only (as per test requirements). To define better the operating characteristics of the collector, several additional data points were obtained beyond those requested.

7843 (DOE/NASA/CR—150506) **Thermal performance of MSFC hot air collectors under natural and simulated conditions.** Shih, K. Sr. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Nov 1977. Contract EX-76-A-29-1037. 39p. Dep. NTIS, PC A03/MF A01.

The procedures used and the results obtained from an evaluation test program conducted to determine the thermal performance and structural characteristics of selected MSFC-designed hot air collectors under both real and simulated environmental conditions are presented. Five collectors, serial numbers 5, 6, 8, 10 and 11, were tested in the three-phased program. Phase one consisted of a series of outdoor tests to determine stagnation temperatures on a typical bright day and to determine each collector's ability to withstand these temperatures. Two of the collectors, S/N's 5 and 6, experienced structural deformation sufficient to eliminate them from the remainder of the test program. Of the three remaining collectors, S/N 10 was selected as the test article for the last two phases of the program. Phase two consisted of a series of outdoor tests to evaluate the thermal performance of collector S/N 10 under certain test conditions. The final phase of the program consisted of a series of indoor tests to evaluate the thermal performance of the collector under closely controlled simulated conditions.

7844 (DOE/NASA/CR—150507) **Verification test of the MSFC solar simulator using a Honeywell Double-Covered Liquid Solar Collector.** Shih, K. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Nov 1977. Contract EX-76-A-29-1037. 16p. Dep. NTIS, PC A02/MF A01.

This test program was conducted to obtain additional verification data to support the utilization of the MSFC Solar Simulator for testing solar collectors. The Honeywell double-covered liquid solar collector No. 2 for which thermal performance data under natural outdoor conditions had been previously obtained was installed on the Solar Simulator and subjected to a series of eight tests under the conditions shown. Although these test conditions are not absolutely identical to those of the outdoor tests, they are considered to be sufficiently representative to provide a basis for an accurate comparative analysis of the data recorded for both test programs.

7845 (DOE/NASA/CR—150508) **Indoor test for thermal performance evaluation of Libbey—Owens—Ford Solar Collector.** Shih, K. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Nov 1977. 26p. Dep. NTIS, PC A03/MF A01.

This test program was conducted to evaluate the thermal performance of a Libbey-Owens-Ford liquid collector under simulated conditions. The test conditions and the thermal performance data obtained during the tests conducted on the simulator are described. In addition, a time constant test and incident angle modifier test were conducted to determine the transient effect and the incident angle effect on the collector.

7846 (DOE/NASA/CR—150509) **Thermal performance evaluation of Solar Energy Products Company (SEPCO) "Soloron" collector tested outdoors.** Chiou, J. (Wyle Labs., Huntsville, AL (USA)). Nov 1977. Contract EX-76-A-29-1037. 92p. Dep. NTIS, PC A05/MF A01.

The test results obtained during the performance of a test program conducted to determine the performance of a Soloron solar collector. The test article is a single glazed collector with a nonselective absorber plate using flowing air as the heat transfer medium. The absorber plate and box frame are aluminum and the insulation is one inch isocyanurate foam board with thermal conductivity of 0.11 $Btu/ft^2 \cdot hr \cdot {}^{\circ}/ft$. The tests included the following: time constant test, collector efficiency test, collector stagnation test, incident angle modifier test, load test, weathering test, and absorber plate optical properties test. The results of these tests are tabulated, graphed, or otherwise recorded.

7847 (DOE/NASA/CR—150510) **Indoor test for thermal performance evaluation of Lennox—Honeywell Solar Collector.** Shih, K. (Wyle Labs., Huntsville, AL (USA)). Nov 1977. Contract EX-76-C-29-1037. 28p. Dep. NTIS, PC A03/MF A01.

The test procedures used and the test results obtained from an evaluation test program conducted on a Lennox/Honeywell double-covered liquid solar collector under simulated conditions are presented. The Marshall Space Flight Center Solar Simulator was used in accordance with test requirements. The test article is a flat plate solar collector using liquid as the heat transfer medium. The absorber plate is steel with the copper tubes bonded on the upper surface. The plate is coated with black chrome with an absorptivity factor of .95 and emissivity factor of .12. A time constant test and incident angle modifier test were conducted to determine the transient effect and the incident angle effect on the collector.

7848 (DOE/NASA/CR—150511) **Indoor thermal performance evaluation of daystar solar collector.** Shih, K. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Nov 1977. Contract EX-76-A-29-1037. 49p. Dep. NTIS, PC A03/MF A01.

The test procedures used and results obtained from a test program to obtain thermal performance data on a Daystar Model 21B, S/N 02210, Unit 2, liquid solar collector under simulated conditions are presented. The test article is a flat plate solar collector using liquid as a heat transfer medium. The absorber plate is copper and coated with black paint. Between the tempered low iron glass and absorber plate is a polycarbonate trap used to suppress convective heat loss. The collector incorporates a convector heat dump panel to limit temperature excursions during stagnation. The following tests were conducted: collector thermal efficiency, collector time constant, collector incident angle modifier, collector heat loss coefficient, and collector stagnation.

7849 (DOE/NASA/CR—150513) **Inhibitor analysis for a solar heating and cooling system.** Tabony, J.H. (Southern Univ., Baton Rouge, LA (USA). Dept. of Mechanical Engineering). 1 Jun 1977. Contract EX-76-A-29-1037. 28p. Dep. NTIS, PC A03/MF A01.

A study of potential corrosion inhibitors for the NASA solar heating and cooling system which uses aluminum solar panels is reported. The research consisted of continued testing using the dynamic corrosion system developed previously, along with an economic analysis of the corrosion inhibitors tested in phases one and two. Very good progress was made in finding a suitable inhibitor for the system.

7850 (DOE/NASA/CR—150536) **Installation package for air flat plate collector.** (Life Sciences Engineering, Morrison, CO (USA)). Oct 1977. Contract EX-76-A-29-1037. 25p. Dep. NTIS, MF A01.

Portions of document are illegible.

Life Sciences Engineering developed the Solar II Air Flat Plate Collector, Model SC4X8, under the direction of the National Aeronautics and Space Administration. The Solar II dimensions are 4 feet by 8 feet by $2\frac{1}{2}$ in. The collector weighs 130 pounds and has an effective solar collection area (aperture) of over 29.5 sq ft. This area represents 95% of the total surface of the collector. The Installation, Operation and Maintenance Manual, Safety Hazards Analysis, Special Handling Instructions, Materials List, Installation Concept Drawings, Warranty and Certification Statement are included in the installation package.

7851 (DOE/NASA/CR—150569) **Air—liquid solar collector for solar heating, combined heating and cooling, and hot water subsystems. First quarterly report, November 1, 1976—October 31, 1977.** (Owens-Illinois, Inc., Toledo, OH (USA)). Mar 1978. Contract EX-76-A-29-1037. 82p. Dep. NTIS, PC A05/MF A01.

A collection of quarterly reports prepared by Owens Illinois in the development of an air-liquid solar collector for solar heating, combined heating and cooling, and/or hot water subsystems are presented.

7852 (DOE/NASA/CR—150573) **Indoor test for thermal performance evaluation of sunworks (liquid) solar collector.** Shih, K. (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Dec 1977. Contract EX-76-A-29-1037. 35p. Dep. NTIS, PC A03/MF A01.

This report presents the test procedures used and test results obtained from an evaluation test program conducted on a Sunworks (S/N L1158G) single-covered liquid solar collector under simulated conditions. The Marshall Space Flight Center Solar Simulator was used in accordance with test requirements. The test article is a flat-plate solar collector using water as the heat transfer medium. The absorber plate is copper with copper tubes bonded by soft solder. The plate is coated with Enthone selective black with an absorptivity factor of 0.87—0.92 and an emissivity factor of 0.10—0.20. A time constant test and incident angle modifier test were conducted to determine the transient effect and the incident angle effect on the collector.

7853 (DOE/NASA/CR—150599) **Liquid flat plate collector and pump for solar heating and cooling systems (a collection of quarterly reports).** (Calmac Mfg. Corp., Englewood, NJ (USA)). Jan 1978. Contract EX-76-A-29-1037. 29p. Dep. NTIS, PC A03/MF A01.

This report is a collection of quarterly reports from Calmac Manufacturing Company covering the progress made during the period from October 15, 1976 to October 15, 1977, for the development, fabrication, and delivery of solar subsystems consisting of a solar operated pump, and solar collectors which can be used in solar heating and cooling, or hot water, for single family, multi-family, or commercial applications. These reports have been reformatted, retyped, the pages renumbered, and the cost information removed.

7854 (DOE/NASA/CR—150601) **Preliminary design review package on air flat plate collector for solar heating and cooling system.** (Life Sciences Engineering, Morrison, CO (USA)). Jan 1977. Contract EX-76-A-29-1037. 58p. Dep. NTIS, PC A03/MF A01.

This Preliminary Design Review Package as received from Life Sciences Engineering covers development and fabrication of a prototype air flat plate collector subsystem containing 320 square feet (10-4' x 8' panels) of collector area. The package contains: verification plan; thermal analysis; safety hazard analysis; drawing list; special handling, installation and maintenance tools; structural analysis; and selected drawings.

7855 (DOE/NASA/CR—150612) **Solar heat transport fluid: a quarterly report.** (Houston Chemical Corp., Corpus Christi, TX (USA)). Feb 1978. Contract EX-76-A-29-1037. 17p. Dep. NTIS, PC A02/MF A01.

The progress made from November 1977 to January 1978 on the development and delivery of noncorrosive fluid subsystems is covered. These subsystems are to be compatible with closed-loop solar heating or combined heating and hot water systems. They are also to be compatible with both metallic and non-metallic plumbing systems. At least 100 gallons of each type of fluid recommended by the contractor will be delivered under the contract. The performance testing of a number of fluids is described.

7856 (DOE/NASA/CR—150665) **Indoor test for thermal performance valuation of the life science engineering (air) solar collector.** (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Feb 1978. Contract EX-76-A-29-1037. 36p. Dep. NTIS, PC A03/MF A01.

The test procedure used and the results obtained from an evaluation test program, conducted to obtain thermal performance data on a Life Sciences double-glazed air solar collector under simulated conditions, are described. These tests were made using the Marshall Space Flight Center's solar simulator. A time constant test and incident angle modifier test were also conducted to determine the transient effect and the incident angle effect on the collector. These results and the results of the collector load test are also discussed. The Life Sciences collector, Model Solar II, is an air type, double-glazed (Tedlar for outside glazing and tempered glass for inner glazing) flat plate. The gross collector area is 32 square feet (4 feet by 8 feet) with an aperture area of 30.9 square feet. The absorber plate is coated with 3M Nextel Black.

7857 (DOE/NASA/CR—150713) **Development and fabrication of a concentrating solar collector subsystem (third and fourth quarterly reports).** (Northrup, Inc., Hutchins, TX (USA)). Oct 1977. Contract EX-76-A-29-1037. 28p. Dep. NTIS, PC A03/MF A01.

The Third and Fourth Quarterly Reports covering the period from April 1, 1977, through September 30, 1977 are presented. These reports cover the finalization of designs, fabrication of the new lens, receiver, and tracking box and a review of the contract status.

7858 (DOE/NASA/TM—78165) **Use of the Marshall Space Flight Center solar simulator in collector performance evaluation.** Humphries, W.R. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Apr 1978. Contract EY-76-A-1037. 128p. Dep. NTIS, PC A11/MF A01.

Details of the Marshall Space Flight Center (MSFC) solar simulator construction and operating characteristics are presented. Actual measured values from simulator checkout tests are detailed. Problems encountered during initial startup are discussed and solutions described. Techniques utilized to evaluate collector performance from simulator test data are given. Performance data generated in the simulator are compared to equivalent data generated during natural outdoor testing. Finally, a summary of collector performance parameters generated to date as a result of simulator testing are given.

7859 (DOE/NASA/TM—150514) **Collation of quarterly reports on air flat plate collectors.** (Life Sciences Engineering, Morrison, CO (USA)). 31 Oct 1977. Contract EX-76-A-29-1037. 110p. Dep. NTIS, PC A06/MF A01.

A collection of quarterly reports on the Solar II Air Flat Plate Collectors is presented. The work covers the development and fabrication of a prototype air flat plate collector subsystem containing 320 square feet of collector area. Three instrumented panels were completely assembled with glazing and insulation. Manufacture of the last seven prototype collectors was completed in October 1977.

7860 (UCID—17804-77) **Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.** Merrill, T. (ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 May 1978. Contract W-7405-ENG-48. 71p. Dep. NTIS, PC A04/MF A01.

Six research projects being conducted by the Mechanical Engineering Dept. of LLL are discussed. The subjects covered include the use of solar collectors for producing process heat; irrigation pumping using shallow solar ponds; development of geothermal resources; ceramic expansion engines; and alternative propulsion systems for highway vehicles in order to reduce fossil-fuel consumption. A separate abstract was prepared for each paper.

7861 (UCID—17804-77, pp 2-18) **Inflated cylindrical concentrator for producing industrial process heat.** Gerich, J. 18 May 1978. In Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.

A concentrating solar collector is being developed that will produce hot water or steam up to a temperature of about 170°C. Such a system is of interest because approximately 25 percent of the energy consumed in the United States is in the form of industrial process heat with about 20 percent of this heat used at a temperature of 170°C or below. Such collectors could potentially supply 5 percent of this country's total energy needs in the form of industrial process heat. It is planned to achieve an extremely low cost by using inexpensive, weatherable plastics and by developing a design which does not require tracking of the sun. The use of plastics most likely means replacing these components at regular intervals. It is also believed that the life cycle costs can be kept low. Analysis of this design shows that it can likely compete with fossil fuels such as oil at $15 per barrel. The initial efforts were directed toward developing optical and heat transfer codes to model the concentrator performance. The heat transfer analysis began with the development of a model of the collector based on a thermal resistive network. Results of the codes are discussed.

7862 **Test facility for collectors.** Krochmann, J. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* **3**: No. 3, 15(May-Jun 1978). (In German).

For tests of the quality of solar collectors, defined radiation conditions must be set. The demands to be made on irradiation facilities of this kind are discussed on the basis of the international commission on lighting which refer to the irradiance as well as the spectral distribution of the light radiation. Finally, a simple simulation plant for global radiation is described.

7863 **Solar roof tile.** Vinz, S. German(FRG) Patent 2,642,732/A/. 30 Mar 1978. 6p. (In German).

A solar collector in the form of a roof tile is described. This way, solar collectors can be easily installed in conventional roofs. A detailed description of 'roof tile collectors' and their installation is given.

7864 Set-up to heat liquids by means of solar energy. Piepereit, R. German(FRG) Patent 2,641,119/A/. 23 Mar 1978. 16p. (In German).

The invention described pertains to a device to heat liquids by means of solar energy. The device consists of a heat exchanger that can be connected with a liquid circuit. The heat exchanger, which is inside a casing transparent to sunlight, consists of plastics in the form of a meandering tube. Black-tinted polypropylene with a good UV resistance and high heat uptake is the material of preference.

7865 Solar collector. Schieber, F.; Kolb, G. (to Conradty (C.) Nuernberg G.m.b.H. und Co. K.G. (Germany, F.R.)). German(FRG) Patent 2,641,325/A/. 23 Mar 1978. 17p. (In German).

The solar collector consists of an insulating casing and an absorber heated by solar radiation, through which the medium to be heated flows. In particular the invention intends to improve the efficiency of solar collectors and a faster transfer of the absorbed radiation heat to the medium to be heated. For this reason the absorber consists of a highly porous black material through whose pores the medium to be heated flows. The absorber material may be carbon felt, a charge of granular carbon, black-coloured metal, or black plastic elements. The most suitable heat transfer medium is gas.

7866 Testing of thermal performance of solar collectors. Dittes, W.; Goettling, D. (Stuttgart Univ. (TH) (Germany, F.R.). Abt. Heizung-Lueftung-Klimatechnik). *Klima Kaelte Ing.;* **6**: No. 4, 137-142(1978). (In German).

Suggestions have been made with the aim of rendering the thermal efficiency of solar collectors of various construction comparable, whereby known and already practically applied methods and plants are described. Starting with the theoretical and practical fundamentals of heater testing, an open system test stand is presented to determine the useful and lost thermal power in the laboratory under controllable and defined conditions. Following extensive designs on the setting of a standard mass flow and further standard conditions, a method is presented for experimental determination so that the efficiency curve of a collector can be accurately determined with little measuring expenditure.

7867 Thermal vacuum and low pressure flat solar energy collectors. Reinhard, K. (ERNO Raumfahrttechnik G.m.b.H., Bremen (Germany, F.R.). Bereich Waermetechnik). *Klima Kaelte Ing.;* **6**: No. 4, 131-135(1978). (In German).

The author describes low-pressure or vacuum collectors with the aim of reducing the heat losses from solar collectors due to radiation and to protect radiation-selective absorber layers from corrosion. The constructive measures for frames and covering plates necessary to absorb the atmospheric forces are outlined and their safety is illustrated by tests. A flexible metallic compound between glass and frame is described which maintains the low-pressure or vacuum over a long period. Finally, problems yet to be solved on idling resistance are indicated. Results of power measurements are given for a second part of the article.

7868 Solar collector. Kaplow, R.; Frank, R.L. (to Massachusetts Inst. of Tech., Cambridge (USA)). German(FRG) Patent 2,722,992/A/. 15 Dec 1977. 27p. (In German).

A collector system is described which consists of a large number of collector units arranged side by side. The collectors are swivelling around two vertical axes (one of them on top of the other) and can thus be adjusted to the position of the sun. Solar cells for each collector element generate control signals which are transmitted to a central microprocessor which adjusts the elements with the aid of servomotors. As the time to adjust the solar collectors is short compared with the course of the sun, several collector elements, e.g. also of different buildings, may be connected to one microprocessor.

7869 Simplified construction of reflector vacuum collectors. Rueckstaedter, H. German(FRG) Patent 2,623,862/A/. 15 Dec 1977. 5p. (In German).

This is a supplementary claim to patents P 26 191 07.1 and P 25 52 598.8 in which vacuum collectors are described. It is proposed to design the usual tubes and profiles as one single bottom surface, cover surface, and absorption surface. Apart from this, a method is proposed by which the curved cover plates may be produced by vacuum pressing in a suitable mould.

7870 Covering transparent to light for solar energy flat collectors. Schenkel, G. German(FRG) Patent 2,622,718/A/. 1 Dec 1977. 11p. (In German).

A covering transparent to light for solar collectors is described, which fulfills the requirement for being weather resistant with the lowest possible weight, and, further, offers the possibility of achieving a relatively optimal thermal slot effect of the solar collectors by matching to the existing weather conditions and operating conditions. The covering consists of a combination of a weather resistant outer covering with a relatively flexible and light inner covering, which can be rolled up. The outer covering consists of a glass plate or plastic plate, but the inner covering consists of a thin plastic foil. The inner covering is preferably constructed like a sun roller blind which can be drawn out and wound up on its own.

7871 Solar collector with long Dewar vessel (vacuum flask). Hoerster, H.; Kersten, R.; Mahdjuri, F. (to Philips Patentverwaltung G.m.b.H., Hamburg (Germany, F.R.)). German(FRG) Patent 2,622,252/A/. 1 Dec 1977. 12p. (In German).

The invention refers to a solar collector with a long, double walled cylindrical vessel made of transparent material, which encloses a hollow evacuated space, whose inner tube is provided on the vacuum side over at least half its cylindrical cross section with a layer absorbing the sun's light. The tube touches a liquid transport medium for transferring the heat produced by solar radiation. The transport medium is introduced by means of a feed device projecting into the inner tube, and flows back along the inside of the inner tube.

7872 Solar collector with a covering of evacuated pipes. Bruno, R.; Hermann, W.; Hoerster, H.; Kersten, R.; Klinkenberg, K.; Mahdjuri, F. (to Philips Patentverwaltung G.m.b.H., Hamburg (Germany, F.R.)). German(FRG) Patent 2,615,475/A/. 13 Oct 1977. 15p. (In German).

The invention is based on the problem of creating a solar collector with a vacuum isolation consisting of several evacuated pipes, which is dust tight and rainproof, and in which there is practically no air between the covering pipes and the heat exchanger. According to the stated construction, this is achieved by having the covering pipes in contact over a large area on their underside with the absorber and the heat exchanger.

7873 Solar light collector with a device to release excess heat to the environment. Raetz, K. German(FRG) Patent 2,607,188/A/. 25 Aug 1977. 6p. (In German).

The invention is to prevent overheating and damaging of the solar collector in the case of strong solar irradiation and simultaneous failure of the water pump. A mechanical device is designed for this purpose which at a certain temperature lifts the thermal covering on the back collector wall so that free convection results removing the heat from the collector floor.

7874 Theoretical investigation on the effect of channel spacing on the efficiency of aluminium flat collectors. Hoenisch, S.; Behm, E. *HLH, Z. Heiz., Lueftung. Klim., Haustech.;* **28**: No. 7, 253-256(Jul 1977). (In German).

The channel spacing has hardly any effect on the efficiency of a collector, provided that static operating conditions are postulated. It is therefore more sensible to find a suitable channel spacing from the point of view of creating good flow conditions in the system. Above all one should attempt to ensure that all channels are equally loaded. It is not always useful to use double glazed collectors. For low operating temperatures, the absorption of the covering is greater than the loss due to heat radiation. In certain cases it may therefore be better to use collectors without any covering.

7875 Control devices for solar plants. Sautter, L. *IKZ Fachz. Sanit.-Heiz.-Klima;* No. 21, 67-72(1977). (In German).

This article explains, by using some examples, what requirements are made of control devices for the use of solar energy, i.e. easy operability, great stability over periods of years, small internal consumption of energy. The following are described in detail: differential temperature control, properties of the temperature sensors, construction of a resistance thermometer, improvement of start-up properties with flat collectors, differential temperature proportional control, heat consumption control, coupling of the solar circuit to a central heating system with water heating. Because of the mixed construction using aluminium, copper, steel etc., corrosion problems still have to be solved.

7876 Efficiency of Fresnel lens solar collector. Cobble, M.H.; Smith, P.R.; Boyes, J.D. (New Mexico State Univ., Las Cruces). pp 147-150 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

A theoretical analysis is made of a series of Fresnel lens collectors, in parallel connection, that track the sun to produce wet steam. Equations are developed for the boiler efficiency, the steam quality, and the fluid temperature distribution to be expected in the fluid. A series of experiments run at three mass flow rates and at three pressures verify the theoretical predictions.

HEAT STORAGE

REFER ALSO TO CITATION(S) 7702, 8334

7877 (CONF-770953—, pp 5.129-5.132) **Special fluidized techniques to support solar energy concentrators for power generation.** Bergougnou, M.A. (Univ. of Western Ontario, London); Roy, A.S. 1977.

From Concentrating solar collector conference; Atlanta, GA, USA (26 Sep 1977).

In Solar concentrating collectors.

Sensible heat storage may become an integral part of modern power and thermal energy systems. A promising form seems to be fluidized-bed heat-storage. It is highly versatile, accepts a variety of heat inputs and outputs, is based on proven technology, and uses cheap, stable, widely available solids. A number of possible heat input and output schemes are possible, such as submerged heat transfer, baffled tower heat-transfer, direct solar-input to storage solids, direct solar pickup by storage solids in solar concentrators, and mobile heat transfer pods for both input and output. Several potential areas for application could be contemplated and a research and development program is required to work out proof-of-concept design and system studies. For that purpose one may use the vast industrial experience on fluidized beds that has been accumulated on thousands of units in a wide variety of processes. Typical of those units are calciners which are operating around the clock at temperatures around 1000°C. Fluidized beds are resilient and reliable. In catalytic crackers in the petroleum industry, hundreds of tons of revolving fluidized beds can run 3 to 5 years before stopping for a turn-around for routine repairs. Preliminary computations have indicated possible economical advantages in utilizing this industrial experience for the purpose of heat storage for solar power generation. Examples are discussed.

7878 (CONF-771131—, pp 122-126) **Development of a practical photochemical energy storage system.** Kutal, C.; Hautala, R.R.; King, B. (Univ. of Georgia, Athens). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

A solar energy storage system based upon the interconversion of norbornadiene and quadricyclene possesses several attractive features, including high specific energy storage capacity, kinetic stability of the energy rich photoproduct in the absence of suitable catalysts, and relatively inexpensive reactants. Two steps are required in this cyclical system: (1) Energy storage through the sensitized photolysis of norbornadiene to quadricyclene in an endothermic reaction; (2) energy release through the catalyzed reconversion of quadricyclene to norbornadiene in an exothermic reaction. Introduction of the sensitizer and catalyst onto separate polymeric supports facilitates the construction of an actual device in which the energy storage and energy release steps are sequentially coupled. An energy storage system based on these principles could result in the practical use of solar energy for heating buildings and related applications.

7879 (SRO—893-14) **Development of a practical photochemical energy storage system. Annual report, 15 June 1977—14 June 1978.** Hautala, R.R.; Kutal, C.R. (Georgia Univ., Athens (USA). Dept. of Chemistry). 15 Mar 1978. Contract EY-76-S-09-0893. 24p. Dep. NTIS, PC A02/MF A01.

Research on catalysts and sensitizers for the interconversion of norbornadiene to quadricyclene for solar energy storage is reported. Significant progress has been made in several areas over the past year. Quantitative measurements evaluating organic sensitizers and catalysts have been carried out. An exciting new transition metal sensitizer has been discovered. A comprehensive evaluation of the characteristics of polystyrene based heterogeneous sensitizers and catalysts has been made. Recently the first glass functionalized photosensitizers were synthesized. This new class of heterogeneous supports offers several attractive features.

GEOTHERMAL ENERGY

7880 (LBL—7048) **Overview of geothermal technology.** Howard, J.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1978. Contract W-7405-ENG-48. 47p. (CONF-780572—2). Dep. NTIS, PC A03/MF A01.

From Geothermal seminar; Sacramento, CA, USA (9 May 1978).

The technology of geothermal resource development includes the technologies associated with finding the resource, defining it well enough to invest in its development, plumbing it to move the heat from the earth to where it will be used, using it, and finally disposing of it. The base of earth sciences experience needed to adequately project limited data so as to discover and define a geothermal resource is growing rapidly as new resources are developed and elucidated. Technologies for moving the fluid are improving as new challenges are faced, e.g., the development of downhole pumps in order to increase flow rates from costly wells. Although a wide variety of applications of geothermal resources exist, still to be evaluated commercially are the use of binary cycles in electric power production and the possibility of using geothermal energy in the production of heavy water and in sugar milling and refining. Disposal of spent geothermal fluid underground (in contrast to surface disposal) is receiving increasing favor, both because of its greater acceptability from an environmental point of view and because of its beneficial effects on minimizing subsidence and recovering additional heat stored in rock framework of a geothermal reservoir.

7881 (PUB—225) **Geothermal and Geosciences program. Annual report, 1976.** (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1976. Contract W-7405-ENG-48. 55p. Dep. NTIS, PC A04/MF A01.

This report is a reprint of the Geothermal and Geosciences section of the 1976 Annual Report (LBL-5982) of the Energy and Environment Division of Lawrence Berkeley Laboratory. For abstract see LBL-5982.

7882 (USGS-OFR—77-489) **Preliminary bibliography for the Clear Lake-Geysers area, California.** Adam, D.P. (comp.). (Geological Survey, Washington, DC (USA)). 1977. 36p. Geological Survey, Washington, DC.

Research projects in the Clear Lake-Geysers area in Napa, Sonoma, Lake and Mendocino Counties, California, are underway. The preparation of a publication that will give an overview of both USGS and other research in this area on environmental and geologic problems is anticipated. This preliminary bibliography is intended eventually for that publication; it is being circulated now in order to elicit corrections, additions, and other comments from anyone who cares to make them.

USA

REFER ALSO TO CITATION(S) 7888

NON-USA

REFER ALSO TO CITATION(S) 8433

GEOLOGY, HYDROLOGY, AND GEOTHERMAL SYSTEMS

REFER ALSO TO CITATION(S) 7906

7883 (LBL—7060) **Documentation for program OGRE.** Weres, O.; Schroeder, R.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1978. Contract W-7405-ENG-48. 61p. Dep. NTIS, PC A04/MF A01.

The program OGRE is fully operational and allows construction of a grid made up of closed n-sided polygons in 3-space for use in reservoir simulation. The output of the grid construction from OGRE is input for the two-phase reservoir simulator SHAFT78. The output could be made compatible with any of the other related integrated finite difference programs which have evolved from the original TRUMP program. The input to OGRE is simple, consisting basically of one card defining the number of real elements and dummy elements followed by the x, y, z coordinates of each of the elements. The output provides the interface distances and cross-sectional areas, and the element volumes. The plotting of the resulting calculation grid is automatic when the control cards are used as shown.

USA

7884 (USGS-OFR—77-869) **Preliminary catalog of earthquakes in northern Imperial Valley, California, July 1977—September 1977.** Fuis, G.S.; Johnson, C.E.; Jenkins, D.J. (Geological Survey, Menlo Park, CA (USA)). 1977. 22p. Geological Survey, Washington, DC.

Seismic monitoring of the northern section of the Imperial Valley region in Southern California has been underway since 1973, in order to study in detail the relationship between geothermal areas and earthquakes. A description of the network 22-station and a list of preliminary data on earthquakes recorded by the network from July 1977 through September 1977 are presented. (JGB)

7885 (IDO—78-1701.a.1.1.3) **Hydrothermal alteration at the Roosevelt Hot Springs Thermal Area, Utah: Thermal Power Co. well Utah State 72-16.** Rohrs, D.; Parry, W.T. (Utah Univ., Salt Lake

City (USA). Dept. of Geology and Geophysics). Jul 1978. Contract EG-78-C-07-1701. 32p. Dep. NTIS, PC A03/MF A01.

Hydrothermal alteration in drill cuttings from Thermal Power Co. well Utah State 72-16, Roosevelt Hot Springs Thermal Area, Utah, was studied petrographically, supplemented by x-ray diffraction identification of clay minerals and x-ray fluorescence determination of major element composition. The well is located 4.3 km southwest of the old resort and 500 m east of the opal mound. The well was rotary drilled to a total depth of 1254 ft (382 m). All samples described in this report are rotary-drill cuttings collected 10 ft (3.05 m) intervals during drilling.

7886 (IDO—78-1701-a.1.1.2) **Hydrothermal alteration at the Roosevelt Hot Springs Thermal Area, Utah: mineralogy of the clay fraction from cuttings, Thermal Power Co. well Utah State 14-2.** Parry, W.T. (Utah Univ., Salt Lake City (USA). Dept. of Geology and Geophysics). May 1978. Contract EG-78-C-07-1701. 30p. Dep. NTIS, PC A03/MF A01.

In the first part of this study the mineralogy of the clay fraction from drill cuttings from Thermal Power Co. well Utah State 14-2 was determined using x-ray diffraction techniques as part of an investigation of hydrothermal alteration at the Roosevelt Hot Springs Thermal Area. Four types of clay minerals were recognized: potassium mica, mixed layer mica-montmorillonite, montmorillonite, and chlorite. In the second part of the study the chemical composition of drill cuttings from Thermal Power Co. Well Utah State 14-2 was determined using x-ray fluorescence techniques. Results are tabulated. The extent of hydrothermal alteration of plagioclase, hornblende, biotite, sphere, and sulfide minerals is reported. (JGB)

GEOTHERMAL EXPLORATION AND EXPLORATION TECHNOLOGY

GEOPHYSICAL TECHNIQUES AND SURVEYS

REFER ALSO TO CITATION(S) 7884

7887 (LBL—7065) **Self-potential survey at the Cerro Prieto Geothermal Field, Baja California, Mexico.** Corwin, R.F.; Diaz C., S.; Rodriguez B., J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1978. Contract W-7405-ENG-48. 5p. (CONF-780708—26). Dep. NTIS, PC A02/MF A01.

From Geothermal Resources Council meeting; Hilo, HI, USA (25 Jul 1978).

Two self-potential survey lines were run across the producing area of the Cerro Prieto geothermal field, located about 30 km south of Mexicali, Baja California, Mexico in order to determine whether significant self-potential variations were related to the known geothermal activity. Large-amplitude, long-wavelength self-potential anomalies are seen in the Cerro Prieto geothermal field. The inflection points of the anomalies are roughly centered over two major faults thought to act as conduits for the thermal fluids. The form of the anomalies indicates that they may be generated by electrical activity extending to a depth of several km along the fault zones. Thus, self-potential measurements may be helpful in tracing thermally active fault zones in the Cerro Prieto area. (JGB)

7888 (TID—28723) **Gravity and ground magnetic surveys in the Monroe and Joseph KGRA's and surrounding region, south central Utah.** Halliday, M.E.; Cook, K.L. (Utah Univ., Salt Lake City (USA). Dept. of Geology). 1977. Contract EY-76-S-07-1601. 183p. Dep. NTIS, PC A09/MF A01.

Regional gravity data were collected, corrected, and plotted in portions of the Pavant Range, Tushar Mountains, northern Sevier Plateau, the Antelope Range, and throughout Sevier Valley approximately between the towns of Richfield and Junction, Utah. Additionally, detailed gravity and ground magnetic data were collected in the vicinity of hot springs in both the Monroe and Joseph Known Geothermal Resource Areas (KGRA's). Results of this work have provided valuable information regarding large-scale faults throughout the survey area and particularly about faults which control hot springs in the Monroe and Joseph KGRA's. Such information should be of significant help in properly locating future test or production drill holes designed to tap the geothermal energy resources of this region. (JGB)

7889 (USGS-OFR—75-670) **Audio-magnetotelluric data log, station-location map, and telluric profile for San Emidio Known Geothermal Resource Area, Nevada.** Hoover, D.B.; Manydeeds, S.; Martinez, R. (Geological Survey, Washington, DC (USA)). 1975. 8p. Geological Survey, Washington, DC.

Observed apparent resistivity data in ohm-meters, standard error data in ohm-meters, and number of observations are tabulated. (JGB)

7890 (USGS-OFR—77-504) **GEOTHERM user guide.** Swanson, J.R. (Geological Survey, Reston, VA (USA)). 1977. 43p. Geological Survey, Washington, DC.

Portions of document are illegible.

GEOTHERM is a computerized geothermal resources file that contains data on geothermal fields, wells, and chemical analyses from the United States and international sources. The General Information Processing System (GIPSY) on the IBM 370/155 computer is used to store and retrieve data. The GIPSY retrieval program contains simple commands which can be used to search the file, select a narrowly defined subset, sort the records, and output the data in a variety of forms. Eight commands are listed and explained so that the GEOTHERM file can be accessed directly by geologists. No programming experience is necessary to retrieve data from the file.

GEOCHEMICAL TECHNIQUES AND SURVEYS

REFER ALSO TO CITATION(S) 7885, 7886, 7890, 7907

7891 (USGS-OFR—77-559) **Hot springs of the central Sierra Nevada, California.** Mariner, R.H.; Presser, T.S.; Evans, W.C. (Geological Survey, Menlo Park, CA (USA)). Jul 1977. 29p. Geological Survey, Washington, DC.

Thermal springs of the central Sierra Nevada issue dilute to slightly saline sodium chloride, sodium bicarbonate, or sodium mixed-anion waters ranging in pH from 6.4 to 9.3. The solubility of chalcedony appears to control the silica concentration in most of the spring waters. Fales Hot Springs may be associated with a higher temperature aquifer, 150° Celsius or more, in which quartz is controlling the silica concentration. Carbon dioxide is the predominant gas escaping from Fales Hot Springs, the unnamed hot spring on the south side of Mono Lake, and the two thermal springs near Bridgeport. Most of the other thermal springs issue small amounts of gas consisting principally of nitrogen. Methane is the major component of the gas escaping from the unnamed spring on Paoha Island in Mono Lake. The delta D and delta ^{18}O composition of most of the thermal waters are those expected for local meteoric water which has undergone minor water-rock reaction. The only exceptions are the hot spring on Paoha Island in Mono Lake and perhaps the unnamed warm spring (south side of Mono Lake), which issue mixtures of thermal water and saline lake water.

7892 (USGS-OFR—77-606) **Helium sniffer field test: Roosevelt Hot Springs, Utah, October 1975 and March 1976.** Denton, E.H. (Geological Survey, Washington, DC (USA)). 1977. 7p. Geological Survey, Washington, DC.

Examination of the data obtained with the helium "sniffer" during two brief visits to Roosevelt Hot Springs, Utah, led to the observation that: a correlation appears to exist between the location of a previously reported subterranean fault, and the pattern of helium signals obtained from subsurface air samples taken along one of the base lines crossing this fault. An increase of 8 millibars in atmospheric pressure between 23 and 24 October 1975 appears to have caused a decrease of nearly 50 parts per billion in the average abundance of helium in samples taken along the same line on both days. Additional data taken on 24 March at half-mile (0.8 km) intervals along the road to Negro Mag Wash suggest the location of still another fault some two miles (3.2 km) east of the first one. The atmospheric abundance of helium at Roosevelt Hot Springs on both trips was within one percent of 5,240 parts per billion.

7893 (USGS-OFR—77-654) **Chemical, isotopic, and gas compositions of selected thermal springs in Arizona, New Mexico, and Utah.** Mariner, R.H.; Presser, T.S.; Evans, W.C. (Geological Survey, Menlo Park, CA (USA)). Aug 1977. 45p. Geological Survey, Washington, DC.

Twenty-seven thermal springs in Arizona, New Mexico, and Utah were sampled for detailed chemical and isotopic analysis. Sampling in New Mexico and Utah was confined to known geothermal resource areas as designated by the U.S. Geological Survey. By contrast, as many of the major thermal springs of Arizona were sampled as time allowed. The springs issue sodium chloride, sodium bicarbonate, or sodium mixed-anion waters of near neutral (6.2) to alkaline (9.2) pH. High concentrations of fluoride, more than 8 milligrams per liter, occur in Arizona in waters from Gillard Hot Springs, Castle Hot Springs, and an unnamed spring on Eagle Creek, and in New Mexico from springs along the Gila River. Deuterium compositions of the thermal waters cover the same range as those expected for meteoric waters in the respective areas. More than 50% of the gas escaping from Verde Hot Springs, Ariz., Thermo Hot Springs, and Monroe Hot Springs, Utah, and the unnamed springs near San Ysidro, N. Mex., is carbon dioxide. Crater and Joseph hot springs in Utah discharge gas containing 20 to 25% carbon dioxide. Nitrogen is the principal gas discharged by the other thermal springs. The chemical compositions of the thermal waters are interpreted to indicate that Thermo Hot Springs in Utah and Gillard Hot

Springs in Arizona represent hydrothermal systems which are at temperatures higher than 125°C. Estimates of subsurface temperature based on the quartz and Na-K-Ca geothermometer differ by as much as 60°C for Monroe, Joseph, Red Hill, and Crater hot springs in Utah. Similar conflicting estimates of aquifer temperature occur for Verde Hot Springs, the springs near Clifton and Coolidge Dam, in Arizona; and the warm springs near San Ysidro, Radium Hot Springs, and San Francisco Hot Springs, in New Mexico. Such disparities could result from mixing, precipitation of calcium carbonate, or perhaps appreciable concentrations of magnesium.

EXPLORATORY DRILLING AND WELL LOGGING

REFER ALSO TO CITATION(S) 7890

7894 (USGS-OFR—77-243) **Deep drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal exploration well No. 2.** Covington, H.R. (comp.). (Geological Survey, Washington, DC (USA)). 1977. vp. Geological Survey, Washington, DC.

Information is included on the following logs: temperature; compensated sonic; gamma; compensated neutron-formation density; caliber; and, dual induction-laterolog. Lithologic breaks to a depth of 6543 ft. are given. (JGB)

7895 (USGS-OFR—77-616) **Deep drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal exploration well No. 3.** Covington, H.R. (comp.). (Geological Survey, Washington, DC (USA)). 1977. vp. Geological Survey, Washington, DC.

Information is included on the following logs: temperature; dual induction-focused log, including resistivity, spontaneous potential, and conductivity; acoustilog; compensated neutron; gamma; compensated density; and caliber. Three sidetracks, A, B, and C were drilled; information on lithologic breaks for each is given.

7896 (USGS-OFR—77-883) **Deep drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal exploration well No. 3 sidetrack-C.** Covington, H.R. (comp.). (Geological Survey, Washington, DC (USA)). 1977. vp. Geological Survey, Washington, DC.

Information is included on the following logs: temperature; dual induction-focused log; including resistivity, spontaneous potential, and conductivity; spectralog; acoustilog; compensated neutron; gamma; compensated density; and caliber. Three sidetracks, A, B, and C, were drilled. Information on Sidetrack-C lithology is included. (JGB)

LEGAL AND INSTITUTIONAL ASPECTS

REFER ALSO TO CITATION(S) 8435

ECONOMIC AND FINANCIAL ASPECTS

7897 **Making use of moderate temperature geothermal resources.** Kunze, J.F. Spencer, S.G. (EG and G Idaho Inc., Idaho Falls). pp 179-183 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Efforts to evaluate the economic feasibility of the use of moderate temperature geothermal resources (90 to 150°C) are summarized. With anticipated improvements in technology, it is predicted that a binary cycle plant of 50 MW(e) capacity could be competitive with coal. However, techniques to drop costs or increase efficiency by a third are needed. Studies on the feasibility of using geothermal resources for low-temperature industrial process heat and for space heating are encouraging. Space heating is judged to be presently economical and industrial process heating, marginally so. Expected environmental problems center around subsidence and disposal of slightly salty geothermal fluids in large amounts. (JGB)

ENVIRONMENTAL ASPECTS AND WASTE DISPOSAL

REFER ALSO TO CITATION(S) 7269, 7668, 7899, 7905

7898 (UCID—17804-77, pp 35-46) **Geothermal environmental research.** Pimental, K.D. 18 May 1978.

In Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.

Water quality sampling networks were established in 80 locations to monitor municipal drinking water supplies, some domestic water wells, agricultural canals and drains, the two major rivers in the Imperial Valley, and the Salton Sea. Coverage was emphasized in the four major Known Geothermal Resource Areas (KGRAs) in the valley: Salton Sea, Brawley, Heber, and East Mesa. Baseline water samples were collected monthly for 13 months. Analyses on these samples included the following major constituents and trace elements: Na, K, Ca, Mg, Cl, SO_4, CO_3, SiO_2, Ag, As, B, Ba, Cd, Cr, Cs, Cu, F, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Se, Sr, V, Zn, total dissolved solids, pH values, and temperature. (JGB)

GEOTHERMAL POWER PLANTS

REFER ALSO TO CITATION(S) 8433

7899 (TREE—1278) **Semiannual progress report for the Idaho Geothermal Program, October 1, 1977—March 31, 1978.** (Idaho National Engineering Lab., Idaho Falls (USA)). Jul 1978. Contract EY-76-C-07-1570. 73p. Dep. NTIS, PC A04/MF A01.

Well drilling, pipeline construction, and pump tests at the Raft River Geothermal Site are described. Reservoir engineering experiments and injection tests are summarized. Studies of scaling, fouling, and corrosion are discussed. The report details the design of the facility's first electrical generator, a small prototype unit. Plans for two 5-megawatt pilot plants are described. Experimenters' preparations for testing a fluidized-bed industrial dryer are also described. The aquaculture, agriculture, and heat-dissipation/soil-warming experiments continued during the period; modifications to the aquaculture and heat-dissipation facilities are described, and the analysis of crops from the agriculture experiment is discussed. The report outlines the workings of a feasibility study, which is identifying federal installations that could use nearby geothermal resources for space conditioning. Tests of both vertical and horizontal liquid-fluidized-bed heat-exchanger models are described. The University of Utah's work with direct-contact heat exchangers is summarized. The report discusses reservoir engineers' assessment of low-temperature resources near Boise, Sugar City, and elsewhere. The Geothermal Program's environmental effort, which comprises studies of fluorosis and the ferruginous hawk, is also described.

DESIGN AND OPERATION

REFER ALSO TO CITATION(S) 7903

POWER PLANT SYSTEMS AND COMPONENTS

7900 (COO—4051-13) **Historical note on a forerunner of a hybrid fossil-geothermal power plant.** DiPippo, R. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jan 1978. Contract EY-76-S-02-4051. 20p. Dep. NTIS, PC A02/MF A01.

A thermodynamic analysis is presented for a four-stage, flash-steam fossil-superheat hybrid power plant suggested by P. Caufourier. The conclusion in the case of the Caufourier proposed plant is that the fossil superheater cannot be justified on thermodynamic grounds. On the other hand, a purely geothermal four-stage flash-steam plant appears to have a great deal of thermodynamic merit. (JGB)

GEOTHERMAL ENGINEERING

REFER ALSO TO CITATION(S) 7860

DRILLING TECHNOLOGY AND WELL HARDWARE

7901 (DOE/NASA/CR—150512) **Installation package Maxi-Therm S-101 Heating Module.** (Sigma Research, Inc., Richland, WA (USA)). 12 Oct 1977. Contract EX-76-A-29-1037. 31p. Dep. NTIS, PC A03/MF A01.

The installation, operation and maintenance of the Maxi-Therm S-101 Thermosyphon Heating Module is covered. The Maxi-Therm S-101 is a packaged unit, complete with air filter, blower, electrical controls, and a thermosyphon liquid-to-air heat exchanger. It is intended for use in residential solar heating systems and can utilize off-peak electrical power.

CORROSION, SCALING, AND MATERIALS DEVELOPMENT

7902 (BNL—24214) **Polymer concrete materials for use in geothermal energy processes.** Kukacka, L.E. (Brookhaven National Lab., Upton, NY (USA)). Mar 1978. Contract EY-76-C-02-0016. 23p. (CONF-781020—3). Dep. NTIS, PC A02/MF A01.

From 2. congress on polymers in concrete; Austin, TX, USA (25 Oct 1978).

The feasibility of using polymer concretes as materials of construction in geothermal processes has been demonstrated and tests to determine the practicability are in progress. High tempera-

ture polymer concrete systems have been formulated and laboratory, and field tests are being performed in brine, flashing brine, and steam at temperatures up to 500°F (260°C). Results are available from field exposures of up to 18 monthes in four geothermal environments. Good durability at temperatures >392°F (200°C) is obtained with samples containing portland cement-silica sand aggregate. Based upon these results, potential applications for polymer concrete in geothermal processes were identified, and the effects of its use on the cost of electric power generation were estimated. Reductions in the cost of power delivered to the distribution system of approximately 10% were calculated. Redesign of the plants for the optimum utilization of polymer concrete would be expected to result in greater savings.

7903 (HCP/T2289—01) **Results of the initial feasibility program on cavitation descaling techniques for pipes and tubes used in geothermal energy plants.** (Daedalean Associates, Inc., Woodbine, MD (USA)). Jun 1978. Contract EX-76-C-01-2289. 61p. Dep. NTIS, PC A04/MF A01.

The purpose of the program is to develop input parameters and to establish design specifications for a cavitating hydrojet descaling system for pipe cleaning applications. Various design input parameters have been identified in order to establish associated cleaning rates for the type of scale and thickness that has been obtained from field operating environments. Specifically, the following are addressed: (1) the relationship between the jet speed and the cleaning rate; (2) the size and geometry of the nozzle as related to the surface area cleaned; (3) the minimum intensity of erosion for cavitation cleaning; (4) the optimum cavitation parameter as a function of cleaning rate; and, (5) the specific horsepower requirements for the most efficient cleaning rates as defined by the cavitation descaling system. These specific areas of technical evaluation establish the design guidelines for the cavitating hydrojet descaling technique in order to effectively and efficiently remove geothermal scale. The phenomenon of cavitation and the cavitation inception parameter applicable to the descaling and cleaning technique are discussed. The experimental facility, test procedures, results, discussion of data and conclusions and recommendations for the initial feasibility program are identified.

7904 (UCID—17804-77, pp 27-34) **Hydrothermal test facility.** Duncan, J. 18 May 1978.

In Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.

Activities underway in the planning and construction of a field test facility to be built at the south end of the Salton Sea near Niland, Calif., are discussed. The task has been to write the criteria for this High-Temperature/High-Scaling (HT/HS) Test Facility, to lay out the plant, estimate costs and schedules, prepare background data for environmental assessments, and discuss site possibilities with owners of high-temperature brine and land above the brine. Research and development activities at the test facility will be devoted to solving corrosion and scaling problems. The experimenters will work on processes and equipment related to many industries. However, with few exceptions, metal corrosion and silica scaling will be the problems to be solved relative to their process equipment. (JGB)

GEOTHERMAL RESERVOIR AND WELL PERFORMANCE

7905 (LBL—7064) **Study of alternative reinjection schemes for the Cerro Prieto Geothermal Field, Baja California, Mexico.** Tsang, C.F.; Bodvarsson, G.; Lippman, M.J.; Rivera R., J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1978. Contract W-7405-ENG-48. 15p. (CONF-780708—25). Dep. NTIS, PC A02/MF A01.

From Geothermal Resources Council meeting; Hilo, HI, USA (25 Jul 1978).

Results of an initial study of possible reinjection patterns for the Cerro Prieto geothermal field, Baja California, Mexico are discussed. The numerical model and assumptions made are described, then the various cases studied are presented. The resulting data indicate what may be expected from different reinjection schemes and may provide useful guidelines for future reinjection operations at Cerro Prieto and other liquid-dominated geothermal fields. Under the assumptions adopted in these studies, the preliminary results suggest that reinjection of cold brines into the Cerro Prieto reservoir can be safely accomplished without a premature reduction in the temperature of the produced fluids. If the presently available wells, M-3, M-6, and M-7, and M-92, are used for injection, the productive life of the field is strongly dependent upon well M-7. The use of M-7 would probably limit undisturbed production to approximately 30 years; whereas, replacing M-7 by an injection well further away from the production area would lengthen the productive life of the field to over 50 years.

RESERVOIR STIMULATION AND EXTRACTION TECHNOLOGY

7906 (RLO—2227-T21-3) **Secondary recovery method for the extraction of geothermal energy. Final report consisting of two sections: (1) short review of the technique of forced geoheat recovery from sheet-like fluid conductors; (2) heat transfer effects in forced geoheat recovery systems. Reporting period: July 1, 1976—December 31, 1977.** Bodvarsson, G.; Hanson, J. (Oregon State Univ., Corvallis (USA). School of Oceanography). Dec 1977. Contract EY-76-S-06-2227-021. 236p. Dep. NTIS, PC A11/MF A01.

Forced geoheat recovery using naturally occurring fluid conductors, viz., fault zones, basaltic dikes, and open formation contacts are considered in terms of the system physical-economic feasibility. The heat transfer surface area required for an economically viable forced recovery system for direct contact heating applications is estimated based on various geologic and economic parameters. Heat extraction from a hot rock formation based on sheet-like flow involves a balance of the total heat transport of the heat extracting fluid with the conductive heat transport within the rock. The heat recovery efficiency is considered in terms of an idealized flow model in order to estimate the required heat transfer surface area. Various flow characteristics adverse to heat recovery efficiency are likely to occur within the fluid conductors under consideration. These include primarily non-uniform flow within the conductor and fluid losses due to leakage from the conductor. The first order effects of these adverse flow conditions are considered in terms of the idealized flow model using analytic and semi-analytic methods. Furthermore, a significant change in fracture premeability can occur within the conductor due to the thermoelastic response of the rock formation upon cooling. This effect is estimated in terms of the idealized flow model under various flow conditions within the conductor. The results of this work indicate that, under current economic conditions and regional geothermal gradients of 50°C/km or more, the minimum heat transfer surface area per injection/production borehole pair required for an economically viable direct-contact heating system with a 10 to 20 year system lifetime is less than 1 km^2. Under the same conditions, it is found that the minimum required heat transfer surface area for electrical power production systems is 2 to 4 times this figure.

DIRECT ENERGY UTILIZATION

REFER ALSO TO CITATION(S) 7899

GEOTHERMAL DATA AND THEORY

PROPERTIES OF AQUEOUS SOLUTIONS

7907 (LBL—5936) **Compilation of data on fluids from geothermal resources in the United States.** Cosner, S.R.; Apps, J.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1978. Contract W-7405-ENG-48. 112p. Dep. NTIS, PC A06/MF A01.

Portions of document are illegible.

Available data on the chemistry of geothermal fluids from important geothermal resources in the U.S. are presented. Candidates for inclusion in the compilation were fluids from wells, but not hot springs, with a heat capacity exceeding 1 x 10^{18} cal and temperatures greater than 90°C. The data are stored in the computer data base as records. (JGB)

ROCK-WATER-GAS INTERACTIONS

REFER ALSO TO CITATION(S) 7541, 7885, 7886

ISOTOPE AND TRACE ELEMENT STUDIES

REFER ALSO TO CITATION(S) 7891

TIDAL POWER

7908 **Wind, waves, and tides.** Merriam, M.F. (Univ. of California, Berkeley). *Annu. Rev. Energy;* **3**: 29-56(1978).

The state of knowledge and experience with wind, wave, and tidal energy are reviewed. The magnitude of possible future contribution to the energy needs is estimated for each of the three, and they are compared as to their prospects for medium term development. 56 references. (HDR)

TIDAL POWER PLANTS

REFER ALSO TO CITATION(S) 8433

WIND ENERGY

REFER ALSO TO CITATION(S) 7908

WIND ENERGY ENGINEERING

POWER CONVERSION SYSTEMS

REFER ALSO TO CITATION(S) 8433

7909 **Load control for wind-driven electric generators.** Moran, K.E.; Korzeniewski, E.C. US Patent 4,095,120. 13 Jun 1978. Filed date 22 Oct 1976. 26p.

A generator load curve is precisely matched to a winddriven motor characteristic by means of a rotor speed-responsive tachometer effecting stepwise control of field current in the generator. Several variations of the tachometer circuit are described. Field current is controlled by an amplifier, and voltage regulation is effected by an override circuit disabling the amplifier.

ELECTRIC POWER ENGINEERING

POWER PLANTS AND POWER GENERATION

REFER ALSO TO CITATION(S) 8331, 8426

7910 (FE—2452-21) **Hot corrosion/erosion testing of materials for application to advanced power conversion systems using coal-derived fuels. Task II: fluidized bed combustion. First task report, July 1, 1976—December 31, 1977.** Nutkis, M.S.; Loughnane, M.D.; Ernst, M.; Bertrand, R.R. (Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.). Mar 1978. Contract EX-76-C-01-2452. 79p. Dep. NTIS, PC A05/MF A01.

Pressurized fluidized bed combustion offers a potentially efficient technique for energy production by combusting coal in an environmentally acceptable manner. This program entails the operation of the Exxon Pressurized Fluidized Bed Coal Combustion Miniplant to provide a test site for the exposure of specimens of potential fireside heat exchanger alloys and gas turbine materials. The installation and shakedown phase of this program has been completed. Heat exchanger specimen probes and turbine blade materials were exposed to pressurized fluidized bed coal combustion conditions for tests of 17 hours and 100 hours. Temperature control of the 21 heat exchanger probes was excellent, and the probe specimens showed no visible signs of attack after 117 hours of exposure. With the aid of 4 methane injection nozzles in the off gas piping, the temperature at the turbine test section was maintained at 1550°F. During the shakedown tests the flue gas flow decreased to a lower level than intended because of refractory plugs in the pressure reducing station. Temperature at the turbine test section had to be lowered during the run to maintain 9 atm pressure in the combustor. This was accomplished by ceasing methane injection and eventually lowering the combustor temperature. The airfoil-shaped turbine specimens experienced a regular pattern of fly ash deposition.

7911 (HCP/T2461—08) **Industrial application of fluidized-bed combustion. Quarterly technical progress report, April—June 1978.** (Georgetown Univ., Washington, DC (USA)). 1978. Contract EX-76-C-01-2461. 15p. Dep. NTIS, PC A02/MF A01.

This report, the seventh quarterly progress report, reflects significant progress made on plant construction, boiler fabrication, award of prepurchased equipment, shop drawing review and approval, and redesign to meet requirements of equipment shop drawings.

7912 **International water conference.** Pittsburgh; Engineers's Society of Western Pennsylvania (1977). 231p. (CONF-7610107—).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

Twenty-two papers were presented at the meeting. A separate abstract was prepared for each of 9 papers. One paper appeared previously in ERA. The remaining 12 papers were not in scope for the data base. (LCL)

COOLING AND HEAT TRANSFER EQUIPMENT AND SYSTEMS

7913 (BNWL—2268(Rev.)) **Overview of issues affecting the demand for dry and wet/dry cooling for thermal power plants.** Hendrickson, P.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1978. Contract EY-76-C-06-1830. 70p. Dep. NTIS, PC A04/MF A01.

The Dry Cooling Enhancement Program was initiated to: develop economic and performance models for cost optimization of total heat rejection systems using dry and dry/wet cooling; analyze and disseminate operating experience on existing dry-cooled plant performance; and demonstrate certain features of existing technology equipment to provide confidence for specification by utilities. The ultimate objective was to promote water conservation through industry use of dry cooling by developing and demonstrating the reliability of lower-cost systems. The economic, legal, and water availability factors that will contribute to future selection of dry and wet/dry cooling and thus influence the projected market for these types of cooling systems in the next 20 years are considered.

7914 (PNL—2674(Vol.2)) **User's manual for the BNW-II optimization code for dry/wet-cooled power plants.** Braun, D.J.; Bamberger, J.A.; Braun, D.J.; Faletti, D.W.; Wiles, L.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1978. Contract EY-76-C-06-1830. 300p. Dep. NTIS, MF A01.

Portions of document are illegible.

This volume provides a listing of the BNW-II dry/wet ammonia heat rejection optimization code and is an appendix to Volume I which gives a narrative description of the code's algorithms as well as logic, input and output information.

7915 **Ice pond cooling of a power plant.** Geisler, G.C.; Urbanski, J.A.; Witzig, W.F. (Pennsylvania State Univ., University Park). *Nucl. Technol.;* **40**: No. 3, 240-247(Oct 1978).

The primary objective of the study was to analyze the feasibility of using a large ice water heat sink for power plant cooling and to predict the effect of the relatively cool condenser water, produced by this system, on plant performance. For a chosen hypothetical site, the study has shown that a large ice mass could be produced during winter in northern regions and coupled with a 1000-MW(electric) nuclear power plant to provide year-round cooling water as low as 4.5°C (40°F). When introduced into the plant, this water could increase the thermal efficiency of the particular plant chosen from 34.1 to 35.4%. Although the initial cost of this system is above that of a cooling tower, the additional revenue realized through increased plant efficiency can, over the life of the plant, help to offset this increased cost.

7916 **Cooling power technology at a turning point.** Hese, L.H. *Waerme;* **84**: No. 1, 50-51(Mar 1978). (In German).

From freshwater cooling and efflux condenser cooling to wet recirculation cooling, hybrid and dry cooling towers, cooling tower technology has seen a development characterized by higher cooling tower costs and reduced power plant efficiency. Therefore, all research work done at the moment concentrates on making up for the economic losses connected with improved environmental protection.

POWER CYCLES

7917 **Gasifier-combined cycle plant.** Foster-Pegg, R.W. (to Westinghouse Electric Corp.). US Patent 4,099,374. 11 Jul 1978. Filed date 15 Apr 1976. 10p.

A gas turbine set, a heat recovery boiler and a steam turbine are operated in a combined cycle to generate electric power. A gasifier generates fuel gas for the gas turbine from a reaction of fuel and compressed air supplied from the gas turbine. The booster compression process is regenerative, i.e., the air is cooled by the booster outlet air before entry to the booster and the booster outlet air is reheated by the booster inlet air prior to passage to the gasifier. Generated fuel gas is controllably heated by a heater using hot water from the heat recovery boiler. Gasifier process control is provided by a fuel ratio controller which varies the gasifier inlet fuel flow as gasifier inlet air flow varies with plant load changes.

7918 **Computation of optimal characteristics of a manueuverable steam gas device with jet compression.** Grinchenko, D.N.; Aminov, R.Z. *Energetyka;* No. 6, 65-70(Jun 1977). (In Russian).

An examination is made of a combination device for producing peak energy in which a low-potential steam from a unit taken from the overflow pipes between the medium-pressure cylinder and the low-pressure cylinder is injected into the combustion chamber of the gas turbine engine, after the unit's compression in a steam—steam ejector by an acute vapor, a vapor from the hot filament of the industrial excess heat or from the medium-pressure cylinder's separation products. Expressions were found for the optimal degrees of

pressure rise in the gas turbine engine and the results of that computation are presented.

7919 Low grade heat utilization by an organic bottoming cycle. Parchim, N.F. (St. Regis Paper Co., Milwaukee, WI); Tsao, K.C. pp 168-173 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

The feasibility of superimposing an organic fluid bottoming cycle to an existing or planned steam plant for conserving the energy and to minimize the impact of thermal discharge is examined. Introduction of such an organic fluid bottoming cycle for higher overall thermal efficiency can only be realized when certain operating conditions are met. A thermodynamic computer analysis of the combined cycle efficiency, either ideal or real, on the effect of operating parameters is presented. No attempt was made to give an economic cost analysis because of unknown factors regarding the cost of individual components designed for a specific application of the chosen bottoming cycle working fluids. Because of the suitability of needed thermodynamic properties as power generation working substance and their ample supply, three commercial fluids were chosen for this binary cycle study. The fluids are (1) ammonia, (2) Freon-12, and (3) Fluorinol-90. Another objective is to provide a tool, computer modeling in particular, to evaluate a Rankine cycle performance with potential applicable fluids as working substance. Since no fluid can be used universally for all applications with optimal performance, this study will shed some judgmental light on what characteristics of the system must be present to achieve the highest thermal efficiency.

COMPONENTS

REFER ALSO TO CITATION(S) 8619

7920 Control characteristics of conventional power station block units. Pt. 2. Edelmann, J.; Sindelar, R. (Brown, Boveri und Cie. A.G., Mannheim (Germany, F.R.). Fachbereich Starkstrom und Leitanlagen). *Elektrotech. Z., A;* **99**: No. 8, 484-486(Aug 1978). (In German).

The question of the thermal stresses in the thickwalled components which limit the power transients are discussed.

7921 Fuel control for a multi-engine gas turbine installation. Janes, R.S.; Lloyd, M.E. (to Lucas Industries Ltd.). US Patent 4,100,731. 18 Jul 1978. Filed date 1 Dec 1976. 6p.

The electronic control for a multi-engine gas turbine installation includes two channels each containing a low wins gate with a signal error input and an acceleration limit input, the output of the low wins gate being applied via a high wins gate to an electronic integrator the output of which is compared with a speed signal to provide fuel control for speed governing. For balancing the two channels a difference amplifier provides an output containing information related to the output of one or other low wins gate and the difference between the values of a given parameter of each engine. This acts to control this difference both during steady running and acceleration.

7922 Turbines, steam generators and power plant components. Review of the 1978 Hanover fair. *Elektrizitaetswirtschaft;* **77**: No. 16, 578-582(Jul 1978). (In German).

In the framework of the systems exhibition 'Energy - supply, conversion, distribution', visitors of the 1978 Hanover Fair were shown technical solutions offered by the industry to all problems in the installation and operation of power plants and heat and/or power supply systems.

7923 Boiler control system design. Hougen, J.O. (Univ of Tex at Austin). *Chem. Eng. Prog.;* **74**: No. 6, 83-85(Jun 1978).

A study was undertaken to obtain data from a large industrial boiler from which control strategies could be developed and control systems designed. A schematic of the boiler and auxiliary systems, showing the control systems in service at the time of testing as well as the test measuring points is shown. This boiler, one of several sering a large chemical complex, produced 550-lb./sq. in. superheated steam at a rated output of 400,000 lb./hr. Natural gas was the principal fuel. A liquid non-volatile residue (NVR) was also used. Steady-state tests were performed at three levels of steam production using various rates of liquid fuel along with natural gas. When no liquid fuel was used, a ratio of 17 lb. steam/lb. of fuel gas was found. The steam-producing capability of the gaseous fuel appeared to be enhanced when liquid fuel was added. Details of the system are given.

7924 Monitoring system for electronic control systems of thermal power plants. Ogawa, M.; Kamei, T.; Matsuo, M.; Hanamura, T. *Tech. Rev., Mitsubishi Heavy Ind.;* **15**: No. 2, 105-111(Jun 1978).

The increasing capacity and efficiency of thermal power plants are making their equipment more sophisticated and complicated and as its result, the function of the automatic plant control system (APC) is becoming all the more important: a minor malfunction of the APC has a great effect on the operation of the whole plant. It is important, therefore, to prevent the malfunction of the APC by detecting any abnormality in its early stage. From this viewpoint, it is an urgent matter to develop an automatic diagnostic or monitoring system having the above functions. A monitoring system for the APC was developed and tests for its practical application were conducted. The monitoring system is composed of four subsystems; that is, sensor, demand, controller and drive unit subsystems, and has such functions as the detection of abnormalities, determining its cause and giving the operation guide in relation to APC. A digital computer MELCOM 350-7 is used for this system. This monitoring system was put to practical tests in October 1976 in a certain thermal power plant and has proved to be able to grasp the exact conditions of the APC, contributing to better operation of the power plant. It is considered that the necessity of this kind of monitoring system will increase in future.

7925 Erosion-reduction for gas turbines with liquid cooling. Giles, W.B. (to General Electric Co., Schenectady, N.Y. (USA)). German(FRG) Patent 2,750,280/A/. 18 May 1978. 23p. (In German).

The paper describes a method to reduce the erosion at the inner surface of a turbine casing due to coolant drops falling on it. The surface is covered with a continuous film of the liquid which absorbs part of the kinetic energy of the falling drops. The thickness of the film is kept within two given limits during normal operation of the turbine.

7926 Possibilities for repair work on the high-temperature components of gas turbines. van Schaik, T. (Elbar B.V., Lomm (Netherlands)). *VGB Kraftwerkstech.;* **58**: No. 5, 330-336(May 1978). (In German).

The welding of combustion chambers, transition pieces and fixed blading is a repair technique commonly accepted by both the manufacturers and also the operators of stationary gas turbine plant. The welding of rotor blades is restricted, by virtue of the present state of welding technology, to the blade component which is subjected to low stresses. In this respect the manufacturers reluctantly pursue the results of collaboration between operators and repair companies in order to contain maintenance costs without increasing risks. Through further development of apparatus of synthetic material and of heat treatment techniques, Elbar hopes in the coming years to eliminate to a large extent the constraints which today remain on welding rotor blades.

7927 Specific corrosiveness on the basis of distribution ratios in the two-phase zone during condensation. Bohnsack, G. (Bayer A.G., Leverkusen (Germany, F.R.). Ingenieurbereich Energie). *VGB Kraftwerkstech.;* **58**: No. 5, 373-378(May 1978). (In German).

Vibrational crack corrosion on turbine blades is an old problem, for which so far no satisfactory solution has been found. As, in general, the cause has been attributed to inferior steam quality, there has been a demand for tightening up of the VGB Guidelines on Steam Purity. In this work an attempt is made to describe the local physical and chemical conditions at the point of blade fracture and to demonstrate the influence of parameters such as salt concentration, pH value and redox ratios, which are decisive for steam quality.

7928 Two-media processes in large-scale power plants. Buch, A. *Energie;* **30**: No. 3, 91-93(Mar 1978). (In German).

The paper describes two-media processes with steam in the primary stage and a lower-boiling fluid - ammonia in the present case - in the secondary stage, and the auxiliary power to be gained with the aid of this process.

7929 Stress corrosion cracking and fatigue corrosion cracking of steam turbine blades in the transition and wet steam section. Bohnstedt, H.J. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning (Germany, F.R.). Fachgruppe Maschinendynamik); Forchhammer, P. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning (Germany, F.R.). Fachgruppe Korrosion); Effertz, P.H. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning (Germany, F.R.). Inst. Werkstofftechnik); Hagn, L. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning (Germany, F.R.). Fachgebiet Festigkeit). *Maschinenschaden;* **51**: No. 2, 73-79(1978). (In German).

The statistic of the Allianz Versicherungs-AG shows that approx. 64 per cent of all steam turbine blade failures occur in the transition and wet steam stages. This high percentage of the total failure volume is due to corrosion influences. A distinction is made between uniform surface wear, pitting, crevice corrosion and combined stresses from which the fatigue corrosion cracking and the stress corrosion cracking are of particular importance for the life of a blade. The present article provides an overview of the basic theories and the present damage to the blades of transition and wet steam

stages of steam turbines, in addition, the latest findings are summarized as obtained from a parameter study covering the fatigue resistance characteristics of steel X 20 Cr 13. This study was carried out together with four turbine manufacturers and under the financial sponsorship of the Federal Ministry of Research and Technology.

7930 Modular systems for steam turbines of small and medium output for economic dimensional standardisation. Ostermann, G. *Tech. Mitt. AEG-Telefunken;* **68**: No. 1/2, 9-18(1978). (In German).

Steam turbines of small and medium output are used in industry and in power stations for driving compressors, pumps, other working machines and for power generation. For these purposes they must be optimally suited for the given operating conditions. This constructive dimensional 'tailormade quality' is very extensive because of the many parameters which have to be taken into account. On the other hand, for rationalisation reasons it is essential to use turbines of equal size, or at least made of identical and tested components. AEG KANIS have started standardising in good time, and have developed modular systems for the individual series of types, with which multifarious requirements can be fulfilled in the best possible way, and which guarantee the highest degree of economy and safety in operation.

7931 Medium actuated shut-off valves. Deinlein-Kalb, H. *Tech. Mitt. AEG-Telefunken;* **68**: No. 1/2, 30-32(1978). (In German).

The operational disadvantages of previous shut-off valves mostly originate from the spindle penetrations for actuating the shut-off device, which must be reliably sealed against high pressures. The article describes a shut-off valve which is only actuated by the medium itself, and therefore requires no spindle penetrations. In consequence it is extraordinarily reliable in operation, and is therefore preferred as a fast shut-down valve for steam and gas expansion turbines, as its operating times are extraordinarily short.

7932 Fully hydraulic turbine control by AEG KANIS. Schliermann, E. *Tech. Mitt. AEG-Telefunken;* **68**: No. 1/2, 24-29(1978). (In German).

In the electronic age, steam turbines of medium and high output are still being controlled hydraulically. As turbines of medium output are mainly used in industry and in heating power stations, hydraulic control for such turbines is described. This permits one to solve all existing control problems in the ideal way. The article describes the tasks of standardised pieces of individual equipment and their connection with hydraulic pipelines in the turbine control system.

7933 Optimal time for testing new thermomechanical equipment. Saprykin, G.S.; Larin, E.A.; Goncharenko, O.V.; Malomuzh, I.A. (Saratov Polytech Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 12, 54-57(Dec 1977). (In Russian).

A minimax method of determination of the optimal time for testing the prototype of a thermomechanical equipment unit is employed. This method also takes account of the specific conditions of operation of the equipment and the extent of tests. A formula for determining the optimal testing time is obtained. Using the example of different promising gas turbine plants, the effect of the unit capacity of a gas turbine plant, fuel costs, efficiency, and the number of hours of plant use on the value of the optimal time for testing the prototype is demonstrated.

7934 Effect of drop interaction on erosion test results. Perel'man, R.G.; Saprunov, G.I. (Moscow Aviat Inst im. S. Ordzhonikidze, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 12, 69-73(Dec 1977). (In Russian).

The possibility of high-speed interaction between splashing liquid drops upon impact against a solid body is considered. It is shown that the effect of such interactions on erosion wear of turbine blades is negigibly small while it may be determinant in the case of experimental plants. In order to be able to compare experimental data obtained by different authors and to use them in calculating erosion eear of turbine blades, the distance between drop centers during their simultaneous interaction must be greater than 6 drop diameters.

7935 Design and performance of transpiration-cooled combustion systems. Bayley, F.J.; Cornforth, J.W. (Univ of Sussex, Appl Sci Lab, Engl). *Proc. Inst. Mech. Eng. (London);* **191**: No. 20, 153-160(1977).

This report describes a comprehensive experimental investigation of a gas turbine combustion system incorporating a porous, transpiration-cooled flame tube. The effectiveness of this system of cooling is demonstrated and the general performance of the chamber reported. From the observations of distributions of pressure and temperature, and hence coolant flows, heat fluxes are derived and compared with theoretical predictions. On the basis of these comparisons a design method is proposed for advanced combustion systems in which transpiration cooling can be employed to reduce cooling air requirements by a factor of four compared with conventional systems.

7936 Operating experiences with the reverse osmosis system at Harrison power station. Hughes, T.R.; Windon, R.D. (Monongahela Power Co., Heywood, WV). pp 1-11 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

Experience in installing, operating, and developing control equipment for a 250 gpm reverse osmosis unit for treating river water used for boiler make-up water at the 1650 MW pulverized coal-fired Harrison Power Station in West Virginia is related. The R-O unit was arranged with 4 modules of 9 permeators each. The R-O method to augment demineralized water supply proved to be the best solution for this power plant when the operators were confronted with having only river water of high conductivity instead of a water supply from both the river and a water reservoir. The problems encountered showed that the operation of the R-O plant and its integration into the make-up system require thorough planning. (LCL)

7937 Condensate polishing experience at Waterlee Station. Derrick, B.A. (South Carolina Electric and Gas Co., Columbia); Atwood, K.L. pp 149-163 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

The magnitude of problems which can occur if condensate polishers are not operated properly in 3500 psig cycles are discussed by relating some of the operating difficulties encountered in Units 1 and 2 at Wateree Station of South Carolina Electric and Gas Company. Wateree Station contains two turbine generator sets nominally rated at 385 MW's each. Steam is generated in two coal-fired steam generators which produce steam at 3500 psig and 1005°F with 1005°F reheat. The steam-water cycles for these units are constructed in accordance with design practice of the 1970's. Each unit contains a full flow mixed deep bed condensate polisher which employs external regeneration. Heaters are tubed with carbon steel and the condenser employs stainless tubing throughout. Cooling water is supplied from the Wateree River and is employed on a once-through basis. No copper was included and provisions were made in the polisher design to allow operation at high pH on the ammonia cycle. The provision of this ammoniation capability, combined with a lack of recommended operating instructions in the proper application of polishers operating past the ammonia exhaustion point, led to serious damage in both Wateree boilers and turbines. This damage occurred because of excessive deposition of preboiler corrosion products in furnace walls, and sodium salt deposition in the turbines. Six months of generation and the revenues associated with the output of a 385 MW unit were lost as a result of the Wateree No. 1 outage. Because the inner high pressure shell of No. 2 turbine had to be sent to the manufacturers' shops for repair, this unit was out of service for 15 months. Control of sodium leakage through condensate polishers is of critical importance in the long term trouble-free operation of a turbine in a once-through cycle.

7938 New requirements for ion exchange incondensate polishing. Abrams, I.M. (Diamond Shamrock, Redwood City, CA). pp 165-177 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

With the advent of all volatile treatment and once-through steam generators, there is an ever increasing need for improved performance of ion exchange condensate polishers. Current needs call for sodium levels below one ppb and chloride levels below 1.5 ppb. During the past two years, there has been extensive discussion in the attempt to answer the following four questions: can these levels be achieved by current ion exchange technology; can these levels be accurately and reliably determined; are these levels really necessary and how can such performance best be achieved. The purpose of this discussion is to provide answers to these questions. The well established fundamentals of the pertinent ion-exchange reactions are stressed with particular emphasis on equilibria as they apply to practical considerations. Although most of the principles discussed apply to both deep beds and pre-coat filters, the practical aspects are concerned mostly with deep-bed polishers. The principal objective of condensate polishing by ion exchange is to produce and maintain effluents which contain less than 1.0 ppb sodium and less than 1.5 ppb chloride. The conclusion reached indicates that these levels can be achieved if the degree of regeneration of cation and anion exchange resins is adequate and if diligence is practiced to avoid contamination of the resins with these ions. Equilibrium calculations suggest that the regeneration requirements are lower for H/OH than for NH_4/OH mixed beds. They further suggest that polishers not be operated beyond the ammonia break immediately follow-

ing a significant exhaustion of the resins by sodium and chloride ions. Leakages of sodium and chloride can be monitored by in-line measurements using ion-specific electrodes.

7939 Evaluating polishing demineralizer performance using cation concentration columns. Dulovich, J.R. (Ohio Edison Co., Stratton). pp 179-185 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

An evaluation program for deep-bed polishing demineralizers (hereafter referred to as polishers) installed at the Ohio Edison's W.H. Sammis Plant, Stratton, Ohio is discussed. The polishers contain gel-type resins which are externally regenerated. The regeneration equipment includes a lime-system, available to exchange sodium from the cation resin which transfer with the anion resin. A six-month program was conducted to monitor the quality of the condensate and the common polisher effluent to determine polisher efficiency. Impurities in the samples were concentrated by means of cation resin columns which were regenerated and the elutant analyzed for various constituents. Initial objectives of the study included: evaluating the amount of leakage from the polishers (primarily sodium); determining the accuracy of continuous sodium monitoring equipment with respect to actual sodium leakage; and evaluating the current water treatment program as it applies to the units being studied. The tests performed produced the following results: regeneration procedures can be effectively monitored and evaluated by means of cation concentration column techniques to insure that the system is performing effectively; by lowering the system's pH, significantly less sodium leakage can be realized; the lime-system is felt to aid in sodium removal and adds protection against condenser leakage; and in reviewing sodium averages from the sodium analyzer vs. the column data, indications are that it is a relatively reliable instrument. In conclusion, the cation concentration column technique has been proven to be a valuable method of evaluating the performance of polishing demineralizers. Further uses of this technique are anticipated in monitoring the effectiveness of future operation beyond the ammonia-break point and establishing the integrity of the additional continuous sodium monitors.

7940 Countercurrent demineralizer at Ohio Edison Sammis Station. Howard, J.R.; Morgan, V.G. (Ohio Edison Co., Stratton). pp 189-192 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

The operation and performance of a counterflow demineralizer at the 2405 MW W.H. Sammis Plant on the Ohio River are discussed. The water purification system used is comprised of three carbon filters followed by a countercurrent demineralizer consisting of one cation exchanger, one two-stage degasifier, one anion exchanger and a resin maintenance tank for backwashing and adding resins when required. The unit also incorporates a sodium hypochlorite system and retention tank prior to the carbon filters to treat the raw well water influent with provisions for a morpholine injection system to the anion effluent for pH adjustments. The main reason the countercurrent demineralizer was purchased was to provide quality water in large quantities in a relatively short time. A problem did exist in early operating cycles with sodium leakage from the anion bed, but this was corrected by installing cartridge type filters between the cation and anion tanks. With this adjustment its performance is meeting all requirements and expectations.

7941 Hideout: a measure of boiler cleanliness--and more. LaLena, P.P. (Long Island Lighting Co., Glenwood Landing, NY). pp 219-225 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

The Long Island Lighting Co. (LILCO) has been using the hideout test technique for thirteen years to determine the need for chemical cleaning. Data from the last six years indicates that hideout testing can also determine the effectiveness of an acid cleaning, and may also be an indicator of corrosion activity in the boiler. Hideout, by definition, is that portion of dissolved sodium phosphate that precipitates from solution as the steam flow increases, reaching minimum soluble concentration at maximum load. As steam flow decreases the reverse is true; sodium phosphate is redissolved, reaching maximum concentration at minimum load. The amount of soluble phosphate, therefore, varies inversely with boiler steam loading. Percent phosphate hideout diminishes with boiler operating time. It is always maximum on a clean boiler, i.e., after a chemical cleaning or start up of a new unit. We have used the hideout data to determine when the boiler requires chemical cleaning believing that the boiler is at its dirtiest when the phosphate hideout is at minimum. The method for calculating the percent phosphate hideout is presented, and the use of hideout measurements as an index of boiler cleaning effectiveness and of boiler corrosion is explained. It is concluded that hideout is a tool for the power station chemist and when properly used valuable benefits are the end results. Tests must be performed regularly, under stringent conditions; the data catalogued and analyzed regularly. If done with the proper positive attitude, the need for chemical cleaning, the effectiveness of the cleaning and the state of boiler corrosion can be determined.

ECONOMICS

REFER ALSO TO CITATION(S) 8427

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 7270, 7668, 8868, 8884

NOXIOUS GAS AND PARTICULATE ABATEMENT AND CONTROL

7942 Fractionation of ash-cinder materials by aggregate density. Panteleev, V.G. *Elektr. Stn.;* No. 1, 20-25(Jan 1977). (In Russian).

The characteristics of separating ash and cinder in thermal electric power plant waste by aggregate density are examined. The reasons for fraction formation are enumerated, and an analysis is made of the flow dynamics of pulp and the stability conditions of channels formed in the ash waste. The computation of the aggregate density of ash and cinder in any ash waste point is made possible by empirical graphic relationships which were constructed on the basis of considerable experimental material obtained at thermal electric power plants which burn various solid fuels and which are equipped with various ash-trapping and hydrotransport systems. 4 references.

POWER TRANSMISSION AND DISTRIBUTION

REFER ALSO TO CITATION(S) 8400

AC SYSTEMS, EHV AND UHV

7943 Fast-decoupled three-phase load flow. Arrillaga, J. (Univ. of Canterbury, Christ Church, New Zealand); Harker, B.J. *Proc. Inst. Electr. Eng. (London);* **125**: No. 8, 734-740(Aug 1978).

Using a reference the single-phase fast-decoupled algorithm, the modifications required to produce an efficient three-phase fast-decoupled load flow are described. The compound-coil concept is used in the representation of power-system components, and the effect of automatic voltage regulators is modelled as part of the reactive-power Jacobian-matrix equation. It is shown that the three-phase modified fast-decoupled load flow displays all the characteristics of the original single-phase version.

7944 Insulators and armatures for overhead H.V. lines. Review of the 1978 Hanover fair. Schlayer, G. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.). Geschaeftsbereich Leitungsbau). *Elektrizitaetswirtschaft;* **77**: No. 16, 550-554(Jul 1978). (In German).

The article reviews the products exhibited and the development trends observed at the 1978 Hanover Fair in the fields mentioned in the title.

7945 Study of the leakage current of hv insulators under glaze and rime. Hara, M.; Phan, C.L. (Univ. of Quebec, Chicoutimi). *Can. Electr. Eng. J.;* **3**: No. 3, 15-22(Jul 1978).

Electrical behavior of iced insulators was investigated by measurement of leakage current and observation of growth and melting of icicles during icing periods. A long rod elastomer insulator or a cap-and-pin porcelain insulator was suspended in a cold room and supercooled droplets directed on them. The leakage current was found to be made of four components: basic leakage current I/sub B/, melting current I/sub M/, white arc current I/sub W/ and flashover current I/sub F/. I/sub M/ and I/sub W/ increased with applied voltage. With glaze icing, an equilibrium was found between melting rate and icing rate, and basic leakage current I/sub B/ was proportional to the icing rate. At low thickness of ice accumulation there was no white arc occurrence at temperature near 0^{0}C. Elsewhere, white arc threshold current was found to be independent of icing regions and equal to about 18 mA rms. Hard rime icing was the most dangerous icing type for H.V. insulators due to the high probability of white arc occurrence.

7946 New technique for transmission system planning. Berg, G.J.; Mamandur, K.R.C.; Subramaniam, P. (Univ. of Calgary, Alberta). *Can. Electr. Eng. J.;* **3**: No. 3, 35-40(Jul 1978).

An efficient method is presented for solving long-range transmission planning problems. Minimizing the present worth of investment required for additional transmission facilities is the main aim of

the proposed algorithm. Further, the method identifies a number of alternative expansion plans in the same computer run.

7947 Importance of the partial-discharge measurement for the detection of faults in plastic-insulated medium-voltage cables. Beinert, J. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken Kabelwerke A.G., Berlin (Germany, F.R.)); El Amir, K. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken Kabelwerke A.G., Duisburg (Germany, F.R.). Hochspannungslabor); Schuppe, W. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken Kabelwerke A.G., Muelheim an der Ruhr (Germany, F.R.)). *Elektrizitaetswirtschaft;* **76**: No. 26, 925-928(Dec 1977). (In German).

The partial-discharge measurements is important not only for the assessment of plastic-insulated cables. By taking into account the knowledge obtained by the location and evaluation of faults an improvement in quality and a reduction of rejects is made possible.

7948 Medium-voltage cables with extruded, removable outer conducting film. Steckel, R.D. (Kabel- und Lackdrahtfabriken G.m.b.H., Mannheim (Germany, F.R.). Geschaeftsbereich Suedkabel). *Elektrizitaetswirtschaft;* **76**: No. 26, 928-931(Dec 1977). (In German).

The author presents medium-voltage cables with extruded, removable conducting film. He mentions the advantages of this construction when compared with cables having a conducting coating as well as cables with a fixed, welded outer conducting film. He reports on tests to confirm the adequate adhesion of the extruded, removable conducting film, even under extreme mechanical and thermal stresses, and mentions the limiting electric strength values which have been determined.

7949 Ethylenepropylene polymer (EPR) as a material for cable fittings when using the push-on technique. Lehmann, K. (Cellpack A.G., Wohlen (Switzerland). Abt. Elektroprodukte). *Elektrizitaetswirtschaft;* **76**: No. 26, 922-924(Dec 1977). (In German).

On the basis of tests, experience and economic considerations the author considers that push-on cable fittings on an elastomer base of ethylenepropylene polymers (EPR) complies with the present state of engineering and that EPR is being more widely adopted in the modern technique of electrical energy transmission.

7950 Heating of power cables with plastic insulation by short-circuit currents. Winkler, R. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken Kabelwerke A.G., Muelheim an der Ruhr (Germany, F.R.). Abt. Entwicklung von Energiekabeln). *Elektrizitaetswirtschaft;* **76**: No. 26, 919-921(Dec 1977). (In German).

New insulating materials for cables and higher short-circuit currents in cable systems caused cable manufacturers and cable users to check the permissible thermal short-circuit currents for low, medium and high voltage cables. For cables with paper insulation these values have been fixed for many years. The question arose of what short-circuit temperatures are permissible for cables with plastic insulation. The author explains the considerations involved in establishing the short-circuit temperatures for the different cable types, and describes short-circuit tests. The advantages of cables with high permissible short-circuit temperatures are listed.

DC SYSTEMS

7951 Static power conversion from self-excited induction generators. Arrillaga, J.; Watson, D.B. (Univ. of Canterbury, Christchurch, New Zealand). *Proc. Inst. Electr. Eng. (London);* **125**: No. 8, 743-746(Aug 1978).

Schemes based on synchronous generators and high-voltage dc transmission are often used to exploit remote natural energy resources. However, unless the provision of synchronous power at the sending end is essential, such schemes are unnecessarily complex. An alternative solution using self-excited induction-generator/controlled-rectifier units, which eliminate the problems of voltage and frequency variations inherent in self-excited induction machines is described. Theoretical and experimental results are provided showing that the self-excited induction generator can operate in the linear region of the magnetization curve while feeding a variable dc load at constant voltage. It is also shown that the unit can be used to feed controllable power into an existing ac network through a dc transmission link.

7952 Novel equidistant pulse control scheme for thyristor converters. Sen, P.C. (Queen's Univ., Kingston, Ont.); MacDonald, M.L.; Clarke, D.J. *Can. Electr. Eng. J.;* **3**: No. 3, 10-14(Jul 1978).

Various firing control systems for phase-controlled thyristor converters can be divided into two groups: individual phase control and equidistant pulse control schemes. The basic principles, advantages and disadvantages of the two groups are discussed. A novel equidistant pulse control scheme, simple and economic, is evolved which tends to combine most of the good features of the presently available firing control systems. Two types of this new control scheme are described and tested experimentally. Their relative advantages and disadvantages are discussed.

SUPERCONDUCTING AND CRYOGENIC SYSTEMS

7953 (BNL—24779) Partial discharge performance of lapped plastic insulation for superconducting power transmission cables and the dielectric strength of supercritical helium gas. Pearmain, A.J.; Kosaki, M.; Thomas, R.A. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 11p. (CONF-781027—2). Dep. NTIS, PC A02/MF A01.

From Conference on electrical insulation and dielectric phenomena; Pocono Manor, PA, USA (29 Oct 1978).

Brookhaven National Laboratory (BNL) has been working on a project to develop a superconducting power transmission cable since 1972. A flexible ac cable with Nb_3Sn superconductor force-cooled by supercritical helium was the design selected. A lapped, multilayer plastic tape construction was selected for the electrical insulation with supercritical helium gas filling the butt spaces between tapes. Evaluation of many different tapes showed biaxially oriented laminated polypropylene tape to be a promising dielectric. A series of tests at BNL on short samples of insulation wound in a cable-type configuration has enabled improvements to be made in screen design and winding techniques. The stress at which discharge inception occurs should be determined by the electric strength of the helium gas in the butt gaps. Some partial discharge results from short sample tests are described, and apparatus with variable electrode spacing developed for studying the effect of electrode material, spacing and area on the breakdown strength of supercritical helium is discussed.

7954 (LA—7465-MS) Thermoelastic analysis of a superconducting cable. Smith, P.D. (Los Alamos Scientific Lab., NM (USA)). Sep 1978. Contract W-7405-ENG-36. 24p. Dep. NTIS, PC A02/MF A01.

The thermoelastic response of a superconducting power transmission cable when it is chilled from ambient to operating temperature is described. The cable consists of coaxial stranded conductors separated with a cylindrical dielectric. Cable end reactions and internal stresses are determined. Sample results for a hypothetical cable indicate that cable end reactions and peak stresses in the strands are sensitive to the initial helix angles and initial helix radii of the conductor strands.

NUCLEAR POWER PLANTS

7955 (TID—3374) Nuclear quality assurance: a bibliography. Rushing, J.W. (comp.). (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). Sep 1978. 85p. Dep. NTIS, PC A05/MF A01.

Included are 375 abstracts to references on nuclear quality assurance and quality control. The abstracts were selected from the DOE Energy Information Data Base (EDB) covering the period January 1976 through June 1978 (approximately). Corporate, personal author, subject, and report number indexes are provided.

7956 New nuclear power plants in Europe 1978. *Atomwirtsch., Atomtech.;* **23**: No. 5, 222-250(May 1978). (In German).

The power reactors now under construction or in the projecting stage in Europe are listed separately for each country.

7957 Aspects of layout and problems regarding the construction and engineering of modern nuclear power plants. Rizzo, F.L. (Ansaldo S.p.A., Genoa (Italy)). *Energ. Nucl. (Milan);* **25**: No. 2, 67-74(Feb 1978).

In this article the engineering aspects of the equipment arrangement inside the building of a nuclear plant, and of the layout of the same, are examined on the basis of the experience mainly acquired during the realization of the Caorso station. Some considerations are then drawn on the difficulties relevant to such a complex project.

7958 Problems of nuclear power in developing countries. Woite, G. (International Atomic Energy Agency, Vienna (Austria)). pp 1084-1087 of Reaktortagung, Hannover. Sektion 8. Reaktor- und Energiesysteme, Wirtschaftlichkeitsfragen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978).

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

The problems of nuclear power in developing countries are different in nature but not less severe than in industrialized countries. So far, only five developing countries with market economies (Argentina, India, Korea, Pakistan, Taiwan) have nuclear power plants in operation with a combined net output of 2.2 GWe. Nuclear

projects with a total capacity of 15 GWe are under construction in these and four other developing countries in Asia and Latin America (Brazil, Iran, Mexico, Philippines). It is expected that most of the future nuclear power installed in developing countries of Asia, Africa and Latin America will be in these countries which have overcome some of the problems of nuclear power.

7959 Operational experience with nuclear power plants in the Federal Republic of Germany. *At. Strom;* **24**: No. 2, 21-54(1978). (In German).

The paper reports on operational experiences in 1977; all nuclear power plants of the German Federal Republic are discussed in separate chapters. Special occurrences in this year are presented in an operating diagram.

7960 Operating U.S. power reactors. Cottrell, W.B. *Nucl. Saf.;* **19**: No. 5, 637-642(1978).

A tabulation is presented of salient information about operating power reactors and covers the May—June 1978 reporting period. These data are taken from the monthly Operating Units Status Report prepared by NRC.

7961 Outlook of energy source and supply. Ando, Y. (Tokyo Univ. (Japan)). pp 745-754 of Fracture mechanics and technology. Volume 2. Sih, G.C.; Chow, C.L. (eds.). Alphen aan den Rijn, Netherlands; Sijthoff (1977).

From Conference on fracture mechanics and technology; Hong Kong, China (21 Mar 1977).

The various sources of energy are considered, with particular regard to the countries of Asia. The estimate of primary energy demand in Japan is shown. The progress of nuclear power plant construction for ten Asiatic countries is discussed. The uranium production capacity of various countries as reported by the IAEA or OECD is shown. Other possible future energy sources are mentioned.

7962 Nuclear fission reactors. pp 5.7-5.46 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Information is presented concerning reactor kinetics, U.S. power reactors, worldwide nuclear power plants, comparison of various types of power reactors, and energy-supply projections for the U.S. A glossary of nuclear terms is included.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, BOILING WATER COOLED

REFER ALSO TO CITATION(S) 8117, 8119, 8120, 8121, 8207, 8266, 8268, 8277, 8286, 8293, 8297, 8307, 8311, 8327, 8328

7963 Preoperational test, start-up tests and operating experience for Fukushima Daiichi Nuclear Power Station Unit-3. Enomoto, M. (Tokyo Electric Power Co., Inc. (Japan)). *Nippon Genshiryoku Gakkaishi;* **19**: No. 8, 530-534(Aug 1977). (In Japanese).

Fukushima Daiichi Nuclear Power Station Unit-3 is a BWR unit located in the seaside area of Okuma town in Fukushima Prefecture. Its thermal output is 2,381MWt; and the electrical rating is 784 MWe. The construction at the site started in Aug. 1971; and the commercial operation began on Mar. 27, 1976. The plant has been operated satisfactory and was shutdown Mar. 1, 1977 for the first annual inspection outage. Here are the plant facility and the operating experience.

7964 (EPRI-NP—812) **Determination and microscopic study of incipient defects in irradiated power reactor fuel rods. Final report.** Pasupathi, V.; Perrin, J.S.; Roberts, E. (Battelle Columbus Labs., OH (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA)). May 1978. 358p. Dep. NTIS, PC A16/MF A01.

This report presents the results of nondestructive and destructive examinations carried out on the Point Beach-1 (PWR) and Dresden-3 (BWR) candidate fuel rods selected for the study of pellet-clad interaction (PCI) induced incipient defects. In addition, the report includes results of examination of sections from Oskarshamn-1 (BWR) fuel rods. Eddy current examination of Point Beach-1 rods showed indications of possible incipient defects in the fuel rods. The profilometry and the gamma scan data also indicated that the source of the eddy current indications may be incipient defects. No failed rods or rods with incipient failure were found in the sample from Point Beach-1. Despite the lack of success in finding incipient defects and filed rods, the mechanism for fuel rod failures in Point Beach-1 is postulated to be PCI-related, with high startup rates and fuel handling being the key elements. Nine out of the 10 candidate fuel rods from Dresden-3 (BWR) were failed, and all the failed rods had leaked water so that the initial mechanism was observed. Examination of clad inner surfaces of the specimens from failed and unfailed rods showed fuel deposits of widely varying appearance. The deposits were found to contain uranium, cesium, and tellurium. Transmission electron microscopy of clad specimens showed evidence of microscopic strain. Metallographic examination of fuel pellets from the peak transient power location showed extensive grain boundary separation and axial movement of the fuel indicative of rapid release of fission products. Examination of Oskarshamn clad specimens did not show any stress corrosion crack (SCC) type defects. The defects found in the examinations appear to be related to secondary hydriding. The clad inner surface of the Oskarshamn specimens also showed uranium-rich deposits of varying features.

7965 (NEDG—23549) **Subcooled counter-current flow limiting characteristics of the upper region of a BWR fuel bundle.** Jones, D.D. (General Electric Co., San Jose, CA (USA). Boiling Water Reactor Systems Dept.). Jul 1977. 89p. General Electric Co., San Jose, CA.

Results of an adiabatic, single bundle test program to determine the subcooled counter-current flow limiting (CCFL) characteristics of the upper region of a BWR fuel bundle are presented. Data are reported for three methods of inlet water injection and three methods of steam injection. The results show that the CCFL characteristics are affected by the methods of both steam and water injection. It is also shown that CCFL with subcooled liquid injection is characterized by the steam condensing capability of the inlet water.

7966 (NUREG/CP—0004(Vol.1), pp 229-238) **Dosimetry method for light water reactors.** Martin, G.C. Jr. (General Electric Co., Pleasanton, CA). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

In multiple foil dosimetry a combination of fission and non-fission monitors is used for materials irradiation in reactors. Each monitor is sensitive to different neutron energy ranges, and increased accuracy in the resultant flux density spectrum is achieved by the use of monitors that collectively embrace the entire significant energy range. This report describes a neutron dosimetry method for light water reactor irradiation experiments. Included in this description are the methods, procedures, and special handling designs which have been developed at G.E.-Vallecitos to assist the experimenter in the planning and design of the dosimeter portion of his experiment for characterizing the neutron environment. Pre-irradiation planning and procedures are described along with monitor selection, preparation, and an encapsulation method using quartz seeds. Cadmium oxide-copper tubes have been fabricated to successfully serve as thermal neutron shields. In some cases, miniaturization of dosimetry materials is necessary to cope with space limitations and to avoid flux gradients. Post-irradiation procedures for handling and analysis of the dosimeters are described. Radioanalysis of all dosimeters is performed by direct counting obviating chemical procedures. Cross-section problems, including integral comparison, are discussed.

7967 (NUREG/CP—0004(Vol.1), pp 389-399) **Some problems encountered in dosimetry of irradiations of burnable poisons.** Grifoni, S.; Lloret, R.; Pistella, F. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

In the framework of a BWR fuel study, an experimental program consisting of the irradiation of poisoned fuel pins was carried out in the reflector of a swimming-pool type reactor (SILOE). Different types of fuels (uranium oxide 2.5% enriched or uranium-plutonium oxide, with 1 and 2% of gadolinium oxide), placed in two devices (with NaK or boiling water), were irradiated under specified conditions. For some irradiations, a continuous measurement of total power vs. time was performed, until the complete burn-up of the poison. For the others, the aim was to produce fuel samples of different burn-up rates of the poison, for further examinations. In the paper, dosimetry of these irradiations is described, which is based on the continuous signals observed from "collections" (self powered neutron detectors), located outside the device.

7968 (NUREG/CP—0004(Vol.2), pp 627-636) **Analysis efforts to support the EPRI LWR dosimetry program.** Simmons, G.L. (Science Applications, Inc., La Jolla, CA). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The analytical methods being used to support the EPRI dosimetry program are discussed. Results from a study of radiation

environments are presented and compared with similar data from the NSSS vendors. Current work in process is also discussed.

7969 (NUREG/CR—0267) **Fuel rod temperature and pressure response in Halden reactor experiment IFA-226.** MacDonald, P.E.; Owen, D.E.; Waterman, M.E. (Idaho National Engineering Lab., Idaho Falls (USA)). Aug 1978. Contract EY-76-C-07-1570. 49p. (TREE—1238). Dep. NTIS, PC A03/MF A01.

The document presents fuel rod thermal and pressure response data and analysis of computer predictions which improve the present understanding of the performance of light water reactor type fuel rods during normal operation. The data reported and analyzed were obtained during the steady state irradiation of mixed oxide fuel rods to relatively high burnup in Instrumented Fuel Assembly (IFA) 226 in the Halden Boiling Water Reactor located in Halden, Norway. Fuel centerline temperature and rod internal pressure were measured as functions of power and time for rods with various initial pellet-to-cladding gap sizes and fuel densities.

7970 (NUREG/CR—0347) **OTOCI: ORINC to COBRA interface.** Cliff, S.B. (Oak Ridge National Lab., TN (USA)). 10 Jan 1978. Contract W-7405-ENG-26. 46p. (ORNL/NUREG/CSD/TM—4). Dep. NTIS, PC A03/MF A01.

An interface which transforms fuel rod heat transfer experimental data from an ORINC plot file into the format of the input tape of a local version of COBRA IV is described as implemented in the program OTOCI. The operation, including input and output, is described.

7971 Chemical thermodynamics of the system Cs—U—Zr—H—I—O in the light water reactor fuel-cladding gap. Besmann, T.M.; Lindemer, T.B. (Oak Ridge National Lab., TN). *Nucl. Technol.;* **40**: No. 3, 297-305(Oct 1978).

Equilibrium thermodynamic calculations were performed on the Cs-U-Zr-H-I-O system that is assumed to exist in the fuel-cladding gap of light water reactor fuel under in-reactor, steam, and 50% steam—50% air conditions. The in-reactor oxygen potential is assumed to be controlled by either UO/sub 2+x/ + Cs_2UO_4 or Zr + ZrO_2. The important condensed phases in-reactor are UO/sub 2+x/, Cs_2UO_4, and CsI, and the major gaseous species are Cs, Cs_2, CsI, and Cs_2I_2. The presence of steam does not alter these species, although CsOH also becomes a major gaseous species. In a 50% steam—50% air mixture, the equilibrium condensed phases are U_3O_8 or UO_3 and $Cs_2U_{15}O_{46}$. Under a nonequilibrium situation where zirconium metal can react with iodine, ZrO_3 or liquid ZrI_2 is present, and the gaseous species ZrI_3 and ZrI_4 have large partial pressures.

7972 Nuclear reactor coolant channels. Macbeth, R.V. (to UKAEA London Office). British Patent 1,500,436/A/. 8 Feb 1978. 3p.

Reference is made to coolant channels for pressurised water and boiling water reactors and the arrangement described aims to improve heat transfer between the fuel rods and the coolant. Baffle means extending axially within the channel are provided and disposed relative to the fuel rods so as to restrict flow oscillations occurring within the coolant from being propagated transversely to the axis of the channel.

7973 Design, construction and erection of the biological shield wall for the Caorso nuclear power station. Crucitti, N. (Ansaldo S.p.A., Genoa (Italy)). *Energ. Nucl. (Milan);* **25**: No. 2, 75-84(Feb 1978).

This article describes the major aspects of the design, construction and erection of the biological shield wall encircling the reactor pressure vessel of the Caorso nuclear power station (Italy) (BWR-Mark 2, 840MWe).

7974 Fuel rod vibration induced by coolant flow in rod assembly. Okazaki, M.; Yamazaki, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *Nippon Genshiryoku Gakkaishi;* **20**: No. 1, 61-70(Jan 1978). (In Japanese).

Fuel rod vibration induced by coolant flow is subjected to not only the rod characteristics such as specific gravity, flexural rigidity and supporing condition at the spacer grid but also the flow conditions influenced by the geometry of flow path. This paper presents the experimental results of fuel rod vibration induced by water and air-water two phase flow in JPDR-II type and Advanced Thermal Reactor (FUGEN) type fuel assembly, using model fuel rod which has the same characteristics to the actual fuel rod assemblies. It was revealed that the correlations presented by Burgreen, Paidoussis and Reavis were insufficient to estimate the actual fuel rod vibrations because of differences in the fuel rod and flow characteristics on fuel rod vibration phenomena.

7975 8th partial licence notice for the Kernkraftwerk Kruemmel. *GRS Kurz-Inf., Reihe C;* No. 18, 1(1978). (In German).

The 8th partial licence comprises, special conditions to be met, the construction of the following components: 1.1 Reactor pressure vessel (RPV); 1.2 outer shell of the containment sphere with supporting concrete from the top edge onwards (+ 15.80 m); 1.3 storage facility for new fuel elements; 1.4 overhead travelling crane in the storage facility for new fuel elements; 1.5 walking crane within the area of the big construction opening; 1.6 electronics cases for the operational control.

7976 Rupture of a pipe of the pressurized bearing water system of the Kernkraftwerk Isar. *GRS Kurz-Inf., Reihe B;* No. 1, 1-2(1978). (In German).

While changing over to another pump of the pressurized bearing water system, a pipe burst on Febr 8th, 1978. At that time, there were 19 persons in the reactor building who left after the evacuation alarm had sounded without measurable radiation exposure. The personnel charged with investigating the incident entered the reactor building immediately after the damage had occurred. They were equipped with compressed air breathing apparatuses and accompanied by radiation protection personnel. The overall dose of all persons concerned amounted to 18 mrem.

7977 Gamma-ray spectrometry and chemical analysis data of JPDR-I spent fuel. Natsume, H.; Okashita, H.; Umezawa, H.; Okazaki, S.; Suzuki, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 10, 745-761(Oct 1977).

Precise measurements of burnup and accumulated transuranium elements were carried out on specimens which were taken out from spent fuel of Japan Power Demonstration Reactor (JPDR)-I, by means of chemical analysis and γ-ray spectrometry. Results of the measurements are summarized numerically. Core configuration and operational history of the reactor are also described.

7978 Relief system for limiting overpressures in nuclear power plants, especially power plants with BWRs. Kuehnel, R. (to Kraftwerk Union A.G.). German(FRG) Patent 2,609,571/B/. 15 Sep 1977. 5p. (In German).

Here obviously an injection system is applied, which elsewhere serves for conveying purposes. One or more vent pipes of a pressure suppression system are conducted vertically from above into a suppression chamber with a cushion and terminate below the water surface. A larger pipe section below the water surface contains the installations according to the invention. From an inner pipe steam can be released into the annulus between the inner and an outer pipe and water can enter the inner pipe from the annulus. This is achieved by the injection effect if steam with high flow density, e.g. 1000 kg/m²xsec, flows through the vent pipe into the suppression chamber, subcooled according to its saturation pressure. The steam flow, subdivided several times, is already condensing within both pipes thanks to intensive mixing with water and expansion to the enlarged cross-section of the outer pipe. For manufacturing seasons the relief system is constructed as a separate component being pushed with its inner diameter over the vent pipe and tightly welded to it.

7979 Development of improved containment design for BWR power stations. Ichiki, T. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). *Karyoku Genshiryoku Hatsuden;* **28**: No. 8, 717-722(Aug 1977). (In Japanese).

The type and form of reactor containment vessels are related to the layout of the systems and equipments in nuclear power plants, and due consideration must be paid to them in the first planning stage. In case of BWR power stations, dry containment vessels have been used for small output plants, but with the development of large capacity plants, pressure-controlling type containment vessels have been adopted, and are used as economical and reliable vessels. Three types of the vessels have been developed so far, and their forms are considerably different. In the improvement and standardization of containment vessels in Tokyo Shibaura Electric Co., Ltd., emphasis was placed on the improvement of work efficiency in containment vessels, the reduction of exposure of workers, the feasibility of immediate construction on the basis of sufficient experiences, the shortening of construction period, and the improvement of the aseismatic property. The basic form of the improved containment vessel is Mark-1 type, and has the pressure-controlling pool of torus form. The improvement of the internal layout, the easy construction because of the steel pressure vessel, the installation of the internal wall, the feasibility of vibration-eliminating design of the Mark-1 type and other features of the improved containment vessel are explained.

7980 Model engineering for piping layout of boiling water reactor nuclear power station. Tsukada, H.; Uchiyama, M. (Japan Atomic Power Co., Tokyo); Wada, T.; Jibu, N. *Hitachi Hyoron;* **59**: No. 7, 573-578(Jul 1977). (In Japanese).

Troubles such as interference often occur at the time of installation even if the layout and pipings for a plant are examined and planned sufficiently with drawings. Accordingly, it is very useful to make threedimensional models and to carry out sufficient examination with them for reducing troubles, shortening construc-

tion period, and improving economy. The main features of the examination method with plastic models are that the three-dimensional examination by sight can be made, group consideration is feasible, and the troubles due to the mistake in interpreting complex drawings and others are reduced largely. Lately, the model of 1/20 scale of the reactor building in the Tokai No. 2 Power Station, Japan Atomic Power Co., was made, and model engineering was carried out to solve the interference problem of machinery and equipments and pipings, to secure the working space for in-service inspection, to examine the methods of carrying in and installing various machinery and equipments and pipings, and to determine the piping routes. It was confirmed that the model engineering would be the useful method for future plant engineering, as the results obtained were remarkable. But models are inconvenient to carry and to store, and the copy is not available.

7981 Operator training simulator for nuclear power plant. Shiozuka, H. (BWR Operator Training Center (Japan)). *Keisoku To Seigyo;* **16**: No. 7, 563-569(Jul 1977). (In Japanese).

In nuclear power plants, training of the operators is important. In Japan, presently there are two training centers, one is BWR operation training center at Okuma-cho, Fukushima Prefecture, and another the nuclear power generation training center in Tsuruga City, Fukui Prefecture, where the operators of PWR nuclear power plants are trained. This report describes the BWR operation training center briefly. Operation of a nuclear power plant is divided into three stages of start-up, steady state operation, and shut down. Start-up is divided into the cold-state start-up after the shut down for prolonged period due to periodical inspection or others and the hot-state start-up from stand-by condition after the shut down for a short time. In the cold-state start-up, the correction of reactivity change and the heating-up control to avoid excessive thermal stress to the primary system components are important. The BWR operation training center offers the next three courses, namely beginner's course, retraining course and specific training course. The training period is 12 weeks and the number of trainees is eight/course in the beginner's course. The simulator was manufactured by modeling No. 3 plant of Fukushima First Nuclear Power Station, Tokyo Electric Power Co. The simulator is composed of the mimic central control panel and the digital computer. The software system comprises the monitor to supervise the whole program execution, the logic model simulating the plant interlock system and the dynamic model simulating the plant physical phenomena.

7982 Core support structure for nuclear power plants, especially LWRs. Steinkamp, E.; Tautz, J.; Ries, H. (to to Kraftwerk Union A.G.). German(FRG) Patent 2,549,423/B/. 3 Feb 1977. 8p. (In German).

The number of welds of this structure for a reactor core is about halved as compared to the state of the art, manufacturing precision is increased, manufacturing is simplified. The square positions of the support grid guiding fuel assemblies and control rods are formed by joining and welding of equal cross-shaped sectional rods. The 'sectional rod crosses', cut from them to proper height, form the corners, their legs the sides of the square fields. Each side of the square contains only one weld, which, on account of its position, can easily be produced and inspected. The ends of the cross-pieces in the range of the support ring enclosing the grid are first attached to the prefabricated, nearly circular structure with the projecting (over the support ring diameter) length, then cut to circularity and welded to the support ring. Or the relevant exterior parts of the cross-pieces consist of a special cross profile with adapted length of the legs, equal for each of the four circular sections of the support ring. For preparation of the manufacture storing of an equal sided cross profile - and possibly a few non-equal sided ones for the range of the support ring - is sufficient. Attachment and welding with a horizontal weld is chiefly done mechanically resp. automatically. Details about the manufaturing steps are given.

7983 EPRI programs in radiation control at nuclear power plants. Shaw, R.A.; Uhl, D.L. (Electric Power Research Inst., Palo Alto, CA). pp 77-90 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

The Nuclear Power Division of the Electric Power Research Institute is supporting research programs whose goal is to improve plant reliability and availability. As part of this broad overall goal, the control of radiation fields associated with the reactor coolant system is one of the major objectives of the Nuclear Engineering and Operations Department (NE and O). A number of programs which address these objectives have been initiated in the NE and O Department during 1976. Three major contracts which will provide a badly needed Light Water Reactor (LWR) plant chemistry and radiation field data base and at the same time will evaluate methods to reduce and control plant radiation fields are presently under negotiation, with Westinghouse, Babcock and Wilcox, and General Electric. A smaller program to provide LWR radiation field information was recently completed by Nuclear Water and Waste Technology in which the primary system shutdown radiation fields at operating nuclear plants were evaluated and trended as best possible. In conjunction with the NWT radiation field program, a small Technical Planning Study (TPS) to provide additional radiation field information was completed by Babcock and Wilcox in which they monitored shutdown radiation levels at Oconee-1 during its second refueling.

7984 Boiling water reactor. pp 5.57-5.74 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Design and operating characteristics of BWR type reactors are presented. Major components and systems are described.

7985 Method for monitoring stability of channel within a core in a reactor. Monta, K.; Takigawa, Y. (to Nippon Atomic Industry Group Co. Ltd.). Japanese Patent 1977-143-397/A/. 24 May 1976. 6p. (In Japanese).

The object of the method is to obtain a flow rate as a factor for determining a safety limit of hydraulic vibration in a fuel channel within a core from signals of an incore neutron detector in every channel to thereby monitor stability of the fuel channel. On the basis of hydraulic data of fuel channels such as power distribution and flow distribution obtained in each fuel channel, average pressure of fuel channels, measured value relating to inlet sub-cleaning of recycling water and throttling of inlet and outlet orifices, discrimination of stability is effected by a channel stability monitoring device, or on the basis of comparison between the limit value of stability in connecting with those parameters designated among parameters and the actual value thereof, determination of stability allowance is carried out.

7986 Method and apparatus for measuring a flow rate of core coolant in a reactor. Monta, K.; Ando, Y. (to Nippon Atomic Industry Group Co. Ltd.). Japanese Patent 1977-139,897/A/. 18 May 1976. 7p. (In Japanese).

The object of the invention is to measure a flow rate of core coolant, without use of a flow meter heretofore specially provided, by connecting a plurality of incore neutron detectors to an externally located correlator and fuel element flow counting device. Correlated functions of detection signals from an incore neutron detector are measured by a correlator to obtain propagation time of a disturbance in flow, and the signals from the detector and position signals of control rod insertion are routed into the output measuring device to determine a heat output in the neighbourhood of the detector. The channel flow rate is obtained by repeated counting based on the heat output, thus obtaining a tentative differential pressure of the fuel channel. Further, the differential pressure is corrected by repeated counting so that the value obtained by the averaging operation between the propagation time of disturbance in the channel and the adjacent channel value comes into coincidence with the measured value of propagation time of disturbance in flow, and the flow rate when time is in coincidence is obtained.

7987 Method for the purification of reactor water in a light water type reactor. Takeda, S.; Mitani, S.; Osawa, Y. (to to Hitachi Ltd.). Japanese Patent 1977-115,994/A/. 26 Mar 1976. 4p. (In Japanese).

The object of the method is to confine a clad in reactor water in a portion of a coolant passage and discharge it when necessary to purify the reactor water, thereby restricting dispersion of radioactivity over the entirely of the reactor plant, thus lowering a level of radioactivity in various parts in the plant. Thin metal webs are welded to inner portions of piping in a feed and condensation system in the reactor or a recycling system. This metal web is twisted relative to a center axis of the piping so as to form a spiral configuration within the piping. With this twisting, when the coolant passes through the piping, it receives a centrifugal force in a peripheral direction of the piping. Then, the heavy clad is carried toward the inner surface of the piping. Since the inner surface of the piping is formed with fine concavo-convexes or permanent magnets, the clad is adhered thereto. Upon accumulation of clad in a predetermined amount, a pipe to which clad is adhered should be replaced.

7988 Apparatus for the management of fuel channel in a reactor. Yoshioka, R. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-115,993/A/. 26 Mar 1976. 4p. (In Japanese).

The object, in a boiling water reactor, is to accurately grasp an amount of creep of fuel channel. Apparatus comprises means for obtaining a state amount of high-flux distribution, distribution of channel differential pressure, temperature distribution and the like within a reactor, means for counting distribution of creep amount of channel on the basis of said state amount, and means for comparing the creep amount in each channel with a predetermined limited value, and means for displaying results obtained from the foregoing.

7989 Installing and detaching apparatus for a control rod drive mechanism. Akimoto, S.; Watanabe, M.; Yoshida, T.; Sugaya, J.; Saito, T. (to Hitachi Ltd.). Japanese Patent 1977-113,489/A/. 19 Mar 1976. 7p. (In Japanese).

The object of the invention is to facilitate maintenance and repair of a control rod drive mechanism. The apparatus comprises a means moving in a moving direction of a control rod within a reactor vessel, said moving means having a housing mounted thereon, a means mounted on the reactor vessel to release a connection between a control rod drive mechanism connected to the control rod and the control rod, and a means for mounting and removing a fixing means which connects the reactor vessel to the control rod drive means. With this arrangement, cooling water of high radioactivity level may not be leaked outside to thereby notably reduce dangerousness of exposure and materially cut time required for mounting and removing the control rod drive mechanism.

7990 Method of correcting an error in neutron detection. Yoshioka, R. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-113,491/A/. 19 Mar 1976. 4p. (In Japanese).

The object of the method is to provide a method of correcting an error in neutron detection in a boiling water reactor, which can correct lowering of reading of a detector due to occurrence of bypass void to enhance accuracy of power distribution counting and increase safety and economy of the reactor. A neutron detector is disposed within a core in a manner similar to prior arts, and a detection signal from the detector is applied to the device of correcting an error in neutron detection. This correction device is also applied with signals such as a power distribution P from the core, a bypass flow W flowing into a bypass region, an input entropy HIN, a core pressure PR, and the like. That is, let C be the coefficient of correction to reading of the neutron detector, then C = f (R, W, CRD, HIN, PR), where CRD represents a control rod pattern.

7991 Reactor. Neda, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977/113,493/A/. 19 Mar 1976. 7p. (In Japanese).

The object of the invention is to correct a core flow at the time of starting and stopping a recirculation pump. There is provided a boiling water reactor wherein in case of producing a backflow at the time of starting and stopping a recirculation pump, the core flow is corrected in relation to start and stop of the pump to accurately obtain a flow of core cooling water. That is, a flow flowing into a jet pump on the side of recirculation loop is converted by a differential pressure transmitter into electric signals, which signals are inputted into a square operation so as to be converted into flow signals, and signs are determined by a logic circuit due to contacts of a relay obtained by operation/stop signals of the recirculation pump and said signs are multiplied by the flow signals and inputted into an adder, thereby obtaining a total flow signals.

7992 Reactor. Fujibayashi, T. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1977-112,096/ A/. 18 Mar 1976. 6p. (In Japanese).

The object of the invention is to provide a boiling water reactor which can enhance a quake resisting strength and flatten power distribution. At least more than four fuel bundles, in which a plurality of fuel rods are arranged in lattice fashion which upper and lower portions are supported by tie-plates, are bundled and then covered by a square channel box. The control rod is movably arranged within a space formed by adjoining channel boxes. A spacer of trapezoidal section is disposed in the central portion on the side of the channel box over substantially full length in height direction, and a neutron instrumented tube is disposed in the central portion inside the channel box. Thus, where a horizontal load is exerted due to earthquake or the like, the spacers come into contact with each other to support the channel box and prevent it from abnormal vibrations.

7993 Method of housing a nuclear reactor container. Kawabe, R.; Naito, M.; Chino, K. (to Hitachi Ltd.). Japanese Patent 1977-107,495/A/. 5 Mar 1976. 4p. (In Japanese).

The object of the invention is to reduce an impact shock, and to minimize failure of a reactor container, by recirculating a gas within a drywell and a pressure suppression chamber, and by constantly removing a coolant in a vent passage. A drywell for housing a BWR type reactor container is connected to a gaseous space within a pressure suppression chamber. A gas circulating pump is constantly driven during operation of the reactor. A gas in a gaseous space is fed through the drywell to a vent passage communicating the drywell with a coolant region in the pressure-supporting chamber, so that the vent passage can be filled with the gas. Therefore, the impact shock during discharge of the gas into the pressure impact shock chamber at a coolant loss accident can be reduced, and the damage of the reactor container can be prevented.

7994 Method of detecting a failed fuel. Utamura, M.; Urata, M.; Uchida, S. (to Hitachi Ltd.). Japanese Patent 1977-107,494/A/. 5 Mar 1976. 6p. (In Japanese).

The object of the method is to improve detection accuracy of a failed fuel by eliminating a coolant temperature distribution in a fuel assembly. A failed fuel is detected from contents of nuclear fission products in a coolant by shutting off an upper portion of a fuel assembly provided in the coolant and by sampling the coolant in the fuel assembly. Temperature distribution in the fuel assembly is eliminated, by injecting the higher temperature coolant than that of the coolant inside and outside the fuel assembly when sampling, and thereby replacing the existing coolant in the fuel assembly for the higher temperature coolant. The failed fuel is detected from contents of the fission products existing in the coolant, by sampling the higher temperature coolant of the fuel assembly after a temperature passed.

7995 Method of feeding a coolant into a reactor. Suematsu, S.; Uchigasaki, G.; Domon, K. (to to Hitachi Ltd.). Japanese Patent 1977- 102,996/A/. 25 Feb 1976. 5p. (In Japanese).

The object of the method is to suppress a quantity of impurities in a coolant fed into a reactor vessel. The concentration of oxygen in a coolant flowing from a condensation desalting instrument into a feed and condensation piping is measured by an oxygen-concentration detector to feed its signal to an adjusting instrument. A degree of opening of an oxygen flow control valve to maintain the concentration of oxygen in the cooling water flowing within the pipe in the range from about 10 to about 200 ppb. Also, the concentration of oxygen in the cooling water fed to the desalting instrument is maintained at a level less than 2 ppb. Thereby, the total amount of iron flown into the vessel can be suppressed to a fine amount such as less than about 1 ppb.

7996 Device for liquefying and storing exhaust gases containing radioactive substances. Nonaka, A. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1977-101,399/A/. 23 Feb 1976. 3p. (In Japanese).

A method to always maintain an exhaust liquefying and storing tank in a cooled state so that the exhaust gases may be liquefied and stored in a short period of time is described. A liquid nitrogen tank is disposed within a cooling tank with an thermal insulator affixed to inner surfaces thereof, a heat exchanger for precooling the exhaust gases by nitrogen is embedded into said thermal insulator, and an exhaust gas liquefying and storing tank having a liquefyer for liquefying the precooled exhaust gases by the liquid nitrogen encased therein is disposed within the liquid nitrogen tank.

7997 Method of shielding an apparatus from radiation. Hashiba, M. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1977-92,099/ A/. 28 Jan 1976. 4p. (In Japanese).

A method to enhance the safety of installation, maintenance and inspection of a plurality of devices disposed in a row within an accommodating chamber by providing the ceiling slab of the chamber with partitioning shield hatches each provided with a removable partitioning shield is described. When carrying out the operations of inspection and maintenance of a highly radioactive apparatus such as a reactor purification desalting apparatus in a BWR atomic power plant, partitioning shields are inserted into respective partitioning shield hatches provided on opposite sides of the intended apparatus, thus shielding the intended apparatus from the adjacent apparatus to shield the maintenance and inspection personnel from radiation.

POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, NON-BOILING WATER COOLED

REFER ALSO TO CITATION(S) 7964, 7966, 7968, 7969, 7970, 7971, 7972, 7982, 7983, 8118, 8121, 8150, 8201, 8204, 8243, 8262, 8263, 8265, 8267, 8268, 8272, 8277, 8280, 8286, 8291, 8292, 8293, 8296, 8301, 8302, 8303, 8311, 8316, 8317, 8322, 8621, 9315

7998 (BMFT-FB-K—77-08) **Investigation of methods for the degassing of primary coolant water.** Stuenkel, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1977. 36p. (In German). Dep. NTIS (US Sales Only), PC A03/MF A01.

The effectiveness of the xenon degassing from borated water with nitrogen as a carrier gas is experimentally investigated. The parameters for the experiments are: relative low carrier gas flow, predetermined equipment dimensions and safe distance of operation temperature from the boiling point of water. A preloading of the water with purging nitrogen and a following removal of the purging gas by depressurisation has resulted as the most effective method.

7999 (CEN—50(Rev.1A)) **Burnable poison irradiation test.** (Combustion Engineering, Inc., Windsor, CT (USA)). Aug 1977. 56p. Combustion Engineering, Inc., Windsor, CT.

The topical report describes the irradiation program developed to investigate different burnable poison rod material and designs. The purpose of the report is to present (1) technical support

for the irradiation of several test burnable poison rod designs that have not been previously reviewed, and (2) describe the parameters that will be employed in the surveillance program for Combustion Engineering's (CE) standard burnable poison rod for 16 x 16 fuel assemblies. The test burnable poison rods will be placed in a CE reactor using 16 x 16 fuel assemblies, the first such reactor is Arkansas Nuclear One, Unit 2. The irradiation program has four phases. Phase I involves the irradiation of 48 standard burnable poison rods which (1) will be extensively precharacterized prior to irradiation and (2) will undergo interim performance evaluation and detailed post-irradiation examination. Phase II, III, and IV involve irradiation and performance evaluation of a small number of burnable poison rods of different proprietary designs. The report discusses the materials to be used in each phase, the methods of fabricating the rods, and the rods expected behavior in a reactor.

8000 (COO—4325-1) **PWR steam generator chemical cleaning. Phase I, final report: solvent and process development. Volume I.** Rothstein, S. (Consolidated Edison Co. of New York, Inc., New York (USA)). 17 May 1978. Contract EN-77-C-02-4325. 134p. Dep. NTIS, PC A07/MF A01.

Two chemical cleaning solvent systems and two application methods were developed to remove the sludge in nuclear steam generators and to remove the corrosion products in the annuli between the steam generator tubes and the support plates. Laboratory testing plus subsequent pilot testing has demonstrated that, in a reasonable length of time, both solvents are capable of dissolving significant amounts of sludge, and of dissolving tightly packed magnetite in tube/support plate crevices. Further, tests have demonstrated that surface losses of the materials of construction in steam generators can be controlled to acceptable limits for the duration of the required cleaning period. Areas requiring further study and test have been identified, and a preliminary procedure for chemical cleaning nuclear steam generators has been chosen subject to quantification based on additional tests prior to actual in-plant demonstration.

8001 (NUREG/CP—0004(Vol.2), pp 775-787) **Performance of self-powered neutron detectors in pressurized water reactors.** Warren, H.D.; Bozarch, D.P. (Babcock and Wilcox, Lynchburg, VA). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

A typical Babcock and Wilcox pressurized water reactor (PWR) contains 364 rhodium self-powered neutron detectors (SPNDs) and 52 background detectors. The detectors are inserted into the reactor core in 52 dry, multidetector assemblies. Each assembly contains seven SPNDs and one background detector. By mid-1977, eight B and W PWRs, each fitted with SPNDs, were in operation. Many of the SPNDs have operated successfully for more than four years. This paper describes the operational performance of the SPNDs and special tests conducted to improve that performance. Topics included are (1) insulation performance versus neutron dose to the SPND, (2) background signals in the leadwire region of the SPND, and (3) depletion of the SPND emitter versus absorbed neutron dose.

8002 **Civil works at Koeberg.** Jones, I.O. (Electricity Supply Commission, Johannesburg (South Africa)). *Civ. Eng. Contract.;* **12**: No. 9, 15, 17-18(Jun 1978).

Once the location of the nuclear power station had been determined, detailed investigations of the site were undertaken over a long period of time. These studies covered such fields as geology, seismology, hydrology, meteorology and oceanography. All the results from these studies were taken into consideration for the civil design of the nuclear power station.

8003 **Dynamic behaviour of a nuclear power plant with pressurized water reactor and working cooling circuits.** Brosche, D. (Bayernwerk A.G., Muenchen (Germany, F.R.)). *Kerntechnik;* **20**: No. 4, 152-154(Apr 1978). (In German).

An important subject discussed in this technical seminar was the comparison of theoretical analyses and plant behaviour in practice. With this objective in mind, the papers were selected with regard to their contents and order in such a way that the subject, with the emphasis on the thermo- and fluid-dynamical behaviour of the plant as a whole (avoiding LOCA, burn-up), could be discussed from various points of view. The referents came from the fields of reactor safety and industry.

8004 **Condensation heat transfer in an ice condenser.** Aoki, S.; Inoue, A. (Tokyo Inst. of Tech. (Japan). Research Lab. of Nuclear Reactor); Mochizuki, H. *Reito;* **53**: No. 603, 3-10(Jan 1978). (In Japanese).

Condensation processes of steam and air mixture onto a packed bed of ice have been examined under conditions of atomospheric pressure and air weight fraction range 0 -- 0.15. The flow directions of the mixture have been both upward and downward to the packed bed of ice. In the case of downward flow, the inlet pressure of test section remains constant so long as the ice exists. And the pressure increases exponentially with increasing flow rate of steam. While in the case of upward flow, the inlet pressure shows periodic change for most flow conditions, and the peak pressure presents a linear dependency on steam flow rate. It is clarified that steam penetrates into the packed bed of ice only several centimeters.

8005 **Intermediate storage of spent LWR fuel elements: experience and tasks from the fuel element point of view.** Peehs, M.; Fuchs, H.P.; Petri, W.; Schlemmer, F. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)); Unger, H. (Kernkraftwerk Obrigheim G.m.b.H., Obrigheim/Mosbach (Germany, F.R.)). pp 421-424 of Reaktortagung, Hannover. Sektion 3. Brennstoffkreislauf. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

8006 **Steam generator, in particular for PWR reactors.** Guelich, J.; Mayer, H.; Schroeder, H.J.; Schuecktanz, G. (to Siemens A.G., Berlin (Germany, F.R.); Siemens A.G., Muenchen (Germany, F.R.); Sulzer Bros. Ltd., Winterthur (Switzerland)). German(FRG) Patent 2,243,402/C/. 3 Nov 1977. 6p. (In German).

The invention pertains to a steam generator with a U-tube bundle where the danger of corrosion will be reduced by preventing the formation of weak-current regions. This is done by leading the feedwater, which flows along the tube plate to which the ends of the U-tube bundle legs are connected, towards the centre of the tube plate. This is the very point where corrosion products are normally deposited.

8007 **Containment, consisting of steel, for nuclear reactor facilities.** Schabert, H.P.; Strickroth, E. (to to Kraftwerk Union A.G.). German(FRG) Patent 2,551,595/C/. 22 Sep 1977. 7p. (In German).

The spherical steel containemnt is connected with its concrete bottom plate and the adjacent secondary concrete shielding by multiple bolting in such a way that even a heavy earthquake will cause no mutual displacement between steel and concrete structures. In this way damage, e.g. of steam pipes successively penetrating the walls of both structures are prevented. The containment has a more or less spherical shape with diameters between 20 and 50 m, e.g. 45 m for a reactor of 3000 MWsub(th). About the lower third of the sphere is covered with concrete and supported by a concrete bottom plate (spherical segment supported by a concrete cylinder). On a lower horizontal parallel of latitude of the shell of the sphere several boreholes for clamp bolts perpendicularly to the surface of the sphere penetrate the steel containment with its concrete cover and the bottom plate. Nozzle pipes tightly welded to the steel shell serve to guide the clamp bolts. These pipes enclose a volume to be exhausted for leak detection tests. Because of their weight the clamp bolts are mechanically hoisted through their borehole from the space below the bottom plate. Cap nuts put on from within produce the required prestressing of about 500 Mp for each clamp bolt.

8008 **Explosion experiments concerning to the excavation of foundation rock at Ikata 2nd Nuclear Power Station. On the safety in excavation by blasting.** Yoshioka, N.; Nabeoka, S. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). *Denryoku Chuo Kenkyusho Hokoku;* No. 377006, 1-5, 1-40(Sep 1977). (In Japanese).

Blasting experiments were carried out at the Ikata Nuclear Power Station and the vibrational signals were observed by seismometers and strain gauges. The object of these experiments is to investigate the influences of the vibration generated by blasting excavation for the construction of the 2nd. Power Station to the structures and the protection instruments of the 1st. Station. Analysing the data from these experiments, we obtain the standard for the range which can be excavated by blasting and examine the effects of vibration to the protection instruments, though insufficiently. This report describes the results from this analysis.

8009 **1300 MVA turbine generator for Ohi Nuclear Power Plant of the Kansai Electric Power Co.** Matsuda, S.; Uematsu, Y. (Mitsubishi Electric Corp., Kobe (Japan). Kobe Works). *Karyoku Genshiryoku Hatsuden;* **28**: No. 6, 523-533(Jul 1977). (In Japanese).

Mitsubishi Electric Corp. has completed the manufacture of two largest capacity turbo-generators of 1300 MVA for Ohi nuclear power plants in Japan in accordance with the tide of making large size generators for nuclear power plants. The generator and the exciter are driven by being directly coupled with the 1175 MW steam turbine. It is a generator of 1800 RPM and cylindrical, revolving field type, with a hydrogen-cooled rotor, and the main exciter is of brushless, fully enclosed type. The stator of the generator is cooled directly with water. Considerable output increase and reliability improvement have been attempted. In addition, the fol-

lowing points have been considered: electrical loading, magnetic loading, electromagnetic vibration, stator coil, rotor shaft material and vibration. Characteristic test, temperature rise test and other engineering tests have been performed with thermocouples, search coils and strain gauges attached to about 1000 points, to measure temperature, vibration and magnetic flux of respective portions. In the synthetic test, the efficiency was 98.84% at rated turbine output and rated power factor. The temperature rise of stator winding was 33.6 deg C at maximum, its vibration was approximately 30 μm at maximum, and the coil surface strain in abrupt short test was about 1/6 of the breaking strain of the coil. These data indicate that the design is carried out with sufficient margin. It was also confirmed by the mechanical impedance measurement that the resonance point of the frame and bracket does not exist in the operating range.

8010 Titanium condenser tubes. Problems and their solution for wider application to large surface condensers. Sato, S.; Sugiyama, S.; Nagata, K.; Nanba, K.; Shimono, M. (Sumitomo Light Metal Industries Ltd., Tokyo (Japan)). *Karyoku Genshiryoku Hatsuden;* **28**: No. 6, 563-571(Jun 1977). (In Japanese).

The corrosion resistance of titanium in sea water is extremely excellent, but titanium tubes are expensive, and the copper alloy tubes resistant in polluted sea water were developed, therefore they were not used practically. In 1970, ammonia attack was found on the copper alloy tubes in the air-cooled portion of condensers, and titanium tubes have been used as the countermeasure. As the result of the use, the galvanic attack on copper alloy tube plates with titanium tubes as cathode and the hydrogen absorption at titanium tube ends owing to excess electrolytic protection was observed, but the corrosion resistance of titanium tubes was perfect. These problems can be controlled by the application of proper electrolytic protection. The condensers with all titanium tubes adopted recently in USA are intended to realize perfectly no-leak condensers as the countermeasure to the corrosion in steam generators of PWR plants. Regarding large condensers of nowadays, three problems are pointed out, namely the vibration of condenser tubes, the method of joining tubes and tube plates, and the tubes of no coolant leak. These three problems in case of titanium tubes were studied, and the problem of the fouling of tubes was also examined. The intervals of supporting plates for titanium tubes should be narrowed. The joining of titanium tubes and titanium tube plates by welding is feasible and promising. The cleaning with sponge balls is effective to control fouling.

8011 Removal of iron in PWR secondary water by electromagnetic filter. Nakumura, S.; Yamashita, H.; Goda, N. (Kyushu Electric Power Co., Inc., Fukuoka (Japan)); Nagao, T.; Saito, T. *Karyoku Genshiryoku Hatsuden;* **28**: No. 6, 547-561(Jun 1977). (In Japanese).

The effectiveness of the electromagnetic filter (EMF) for removing iron in S.G. blow down water was studied. In addition, the applicability of the EMF for the removal of iron from moisture separator drain (MS) also was studied. A pilot electromagnetic filter was installed in the Genkai Nuclear Power Station in Kyushu. The filter comprises a body filled with packing material, an electromagnetic coil, and insulating material. The packing material is spiral filtration plates made of stainless steel. Predetermined electric current is passed through the electromagnetic coil, and water flows downwards. When pressure loss reaches the predetermined value (about 2 kg/cm^2), water flow is stopped, and the electric current for the electromagnetic coil is stopped. Then, reverse washing begins. The condensate test showed the same result as that in a thermal power plant. As the results of the tests on condensate, MS drain and S.G. blowdown water, the EMF was confirmed to be effective for iron removal from S.G. blowdown water. Although the pressure loss of the MS drain hardly increased, the iron concentration in treated water increased after the water flow for 10-18 hours. The EMF can be applied for the M.S. drain, if it is considered that the regenerating time is about 5 minutes.

8012 Core baffle for nuclear reactors. Machado, O.J.; Berringer, R.T. (to Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). German(FRG) Patent 2,647,459/A/. 26 May 1977. 27p. (In German).

The invention concerns the design of the core of a LWR with a large number of fuel assemblies formed by fuel rods and kept in position by spacer grids. According to the invention, at the level of the spacer grids match plates are mounted with openings so the flow of coolant directed upwards will not be obstructed and a parallel bypass will be obtained in the space between the core barrel and the baffle plates. In case of an accident, this configuration reduces or avoids damage from overpressure reactions.

8013 Arrangement for cooling fasteners in liquid cooled nuclear reactors. Berringer, R.T.; Machado, O.J. (to Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). German(FRG) Patent 2,647,458/A/. 26 May 1977. 31p. (In German).

Fasteners which connect components in a LWR which are situated between the reactor core and the reactor vessel are subjected to heavy mechanical loads and to high temperatures, particularly if they extend through a hollow space formed by the component. According to the invention, flow channels are to be provided which let the coolant circulate in such hollow spaces, where the temperature of the coolant should lie below its boiling point.

8014 Steam generator, in particular for nuclear power plants with PWR reactors. Struszkiewicz, R. (to Vereinigte Oesterreichische Eisen- und Stahlwerke A.G. (VOeEST) - Alpine Montan, Linz). German(FRG) Patent 2,535,475/A/. 24 Mar 1977. 15p. (In German).

An improved design of steam generators for PWR reactors is described which will improve the operating stability while reducing the dimensions. Instead of the usual annular downflow chamber, ther are internal partitions which form a central downflow space between the two legs of the U-tube bundle. The advantages of this arrangement and further constructional details of the steam generator invented are described.

8015 Optimum refuelling strategy in light water reactors. Hermansky, B. *Jad. Energ.;* **23**: No. 3, 1O1-106(Mar 1977). (In Czech).

The flow sheets are presented of refuelling schedules aimed at obtaining deep average fuel burnup with levelling up the output along the reactor radius in large PWR reactors. The zone refuelling is described in which only 1/3 of the fuel element number is replaced. The elements are placed in the outer zone of the core. Also described is the distributed refuelling in which fuel elements with different burnups are evenly spaced. A modified refuelling schedule is shown involving the replacement from the outside to the inside where a uniform radial distribution of thermal output is achieved. Calculation methods are shown of determining the optimum refuelling strategy. Dynamic programming is one of the prospective computer methods. Its general algorithm is indicated. A survey is made of some studies on the optimum refuelling strategy in pressurized water reactors.

8016 Inspection and repair installation for steam generators. Roettger, H.; Kastl, H.; Hagen, H.G.; Mueller, O. (to Siemens A.G., Berlin (Germany, F.R.); Siemens A.G., Muenchen (Germany, F.R.)). German(FRG) Patent 2,263,143/C/. 3 Feb 1977. 8p. (In German).

A tool carrier is described which can be fastened to the tube plate of the steam generator chamber and will facilitate inspection and repair work on the steam generator of a PWR reactor. The tool carrier has a centering device which can be adjusted to the tube plate, a clamping device for fastening, and a movable arm whose free end has a flexible supply tube for measuring equipment or tools for pipe testing and repair. Constructional details of the extension arm are described.

8017 Mathematical model for calculation of the thermodynamic cycle with N_2O_4 working agent. Bubnov, V.P.; Kurtsman, M.V. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 2, 10-14(1977). (In Russian).

An approximate model for the calculation of a thermodynamic cycle of NPP with the N_2O_4 working agent is suggested. The model of the calculation of a thermodynamic cycle occupies over 2/3 of the volume of the "Minsk-32" operative memory. The set problem is solved by methods of the experiment planning. A cycle with intermediate regeneration as the most preferable one for application in a high power NPP is considered. The investigations performed showed that using an approximate calculation model for a thermodynamic cycle gives a relative error less than 4 % in determining technical and economic characteristics of heat exchangers and less than 3 % for thermal and hydraulic characteristics of the core. The results obtained confirm that it is reasonable to use the proposed model when constructing a mathematical model of NPP for optimized investigations.

8018 Pressurized water reactor. pp 5.75-5.86 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Design and operating characteristics of PWR type reactors are presented. Major components and systems are described.

8019 Safety device for a reactor. Hokkyo, N. (to Hitachi Ltd.). Japanese Patent 1977-110,390/A/. 12 Mar 1976. 2p. (In Japanese).

The object to control a rapid coolant loss which causes overheat and fuel failure, when a breakage accident of a recirculation circuit piping of a boiling water reactor happens. A recirculation piping is provided in nonpressurized or pressurized water whereby a pressure difference between inside and outside of the pipe of the recirculation circuit is reduced. A rapid loss of a reactor cooling water can be controlled when a breaking accident of the piping happens.

8020 **Pressurized-water reactor.** Schabert, H.P. (to Kraftwerk Union A.G., Muelheim an der Ruhr (Germany, F.R.)). German(FRG) Patent 2,430,765/B/. 8 Jan 1976. 3p. (In German).

The invention pertains to safety improvements in PWR reactors with two live-steam lines leading out of the containment. Its purpose is to obtain some relief for the steam generator in case of rupture and cut-off of the live-steam lines. It is proposed to connect the two live-steam lines in flow direction behind the isolating valves, using a three-way valve whose third outlet may take over pressur relief if necessary.

8021 (CONF-7609179—3) **Solution of problems at the Obrigheim nuclear power station.** Schenk, H. 1976. Translation of Paper II/I. 17p. British Library Lending Div., Yorkshire, Eng.

From VGB conference on power stations; Stuttgart, F.R. Germany (7 Sep 1976).

The Obrigheim nuclear power station was commissioned in the Autumn of 1968 and started commercial operation in March 1969 with a thermal power of 907 MW (th). On the basis of the measurements carried out in the Spring of 1969 with the plant in operation, and after a number of modifications to the plant, the thermal power of the pressurized water reactor system was increased in December 1969 from 907 to 1050 MW (th). Since that time the nuclear power station has been in base load operation, generating a gross electric power of 345 MW (328 MW net power); about 18,000 million kWh had been generated since 1 July 1976. The mean availability of the plant has been about 86% during the operating period up to now (since the start of the trial run in March 1969). The mean availability was just under 83%. Details are given of a number of particular operating problems and the solutions which were found.

POWER REACTORS, NON-BREEDING, GRAPHITE MODERATED

REFER ALSO TO CITATION(S) 8136, 8206, 8244, 8245, 8246, 8247, 8249, 8250, 8251, 8252, 8253, 8254, 8255, 8256, 8257, 8258, 8259, 8260, 8275, 8277, 8304, 8305, 8313, 8323

8022 (BNL-NUREG—50689(Vol.1), pp 3-13) **Research and development for high temperature gas cooled reactor in Japan.** Taketani, K. (Japan Atomic Energy Research Inst., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The paper describes the current status of High Temperature Gas Cooled Reactor research and development work in Japan, with emphasis on the Experimental Very High Temperature Reactor (Exp. VHTR) to be built by Japan Atomic Energy Research Institute (JAERI) before the end of 1985. The necessity of construction of Exp. VHTR was explained from the points of Japanese energy problems and resources.

8023 (BNL-NUREG—50689(Vol.1), pp 268-281) **Acoustic excitation of containment insulation cover plate.** Fenech, H.; Rao, A.K. (Univ. of California, Santa Barbara). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

An experimental and theoretical program has been implemented by NRC-BNL since 1975 at the University of California, Santa Barbara to assess the reliability of the PCRV thermal insulation cover plate and the possible safety problem caused by the failure of this plate. A typical large HTGR PCRV unit [1160 MW(e)] and thermal insulation class A were selected. The upper core cavity is estimated to be the most critical volume where the noise pressure levels are expected to reach 110 to 130 dB (rel. to 2 x 10^{-4} dynes/cm^2). The noise spectrum in that cavity is a composite of circulator noise, vortex shedding boundary layer turbulence, and flow impingement. Some anticipated safety related problems associated with the thermal insulation failure are examined.

8024 (BNL-NUREG—50689(Vol.1), pp 337-349) **Model tests and elasto-plastic finite element analysis on multicavity type PCRV.** Nojiri, Y.; Yamazaki, M.; Kotani, K.; Matsuzaki, Y. (Kajima Inst. of Construction Tech., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

Multicavity type PCRV models were tested to investigate elastic stress distributions, cracking and failure mode of the models, and to determine the adequacy and relative accuracy of finite element structural analyses. The behavior of the models under pressure was investigated, and it was found that the predictions of the analyses showed a good agreement with the test results.

8025 (BNL-NUREG—50689(Vol.2), pp 1-14) **Overview of Japanese helium technology.** Okamoto, Y.; Kondo, T. (Japan Atomic Energy Research Inst., Ibaraki). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The status of the present Japanese research and development programs on the system and materials for the helium circuit of an Experimental Very High Temperature Reactor (VHTR) is reviewed. A series of earlier exploratory works have stimulated the construction and operation of several helium test facilities of extended scale at JAERI and the related industrial organizations. The program has extended its interactions to many other interdisciplinary areas. The program of developing the structural metals specifically modified for uses in the helium environments has been involved as one of the important activities that support the advances of helium technology.

8026 (BNL-NUREG—50689(Vol.2), pp 15-22) **Overview of the American helium technology program.** Larkins, J.T. (Nuclear Regulatory Commission, Washington, DC). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

A program in confirmatory HTGR safety research was established in 1974 by the USAEC which in 1975 became part of the NRC-Advanced Reactor Safety Research program. The ERDA and General Atomic programs are aimed at the development of the GCR and meeting the licensing requirements of the NRC. A small part of the developer's program does address HTGR safety issues, however, the NRC-ARSR program in GCRs is aimed primarily at the safety issues and attempts to test or confirm the conclusion of the developer and in some instances extends the scope of understanding further—beyond the design basis range. The overview indicates some of the work which is being done in several areas of HTGR safety research. The presentation is focused around the NRC-ARSR Gas-Cooled Reactor Program with an overlay of comparable work being sponsored by ERDA and GA. Six task areas are identified: (1) primary coolant impurities, (2) rapid graphite oxidation, (3) fission product release and transport, (4) materials, (5) safety instrumentation, and (6) analytical research.

8027 (BNL-NUREG—50689(Vol.2), pp 23-35) **Helium test loops at Brookhaven National Laboratory.** Epel, L.G.; Romano, A.J.; Nicolosi, S.L. (Brookhaven National Lab., Upton, NY). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

In support of the United States Nuclear Regulatory Commission's effort on safety research of High Temperature Gas-Cooled Reactors (HTGR's), Brookhaven National Laboratory (BNL) has constructed and is operating two helium test loops. The first loop, built in 1975, was used to perform graphite oxidation experiments and has recently been renovated in order to conduct gas kinetics experiments. The second loop, completed in 1977, is being used to supply a controlled helium atmosphere to metal specimens in mechanical testing machines. The two loops are described and some of the results of the graphite oxidation-tensile strength experiments as well as some preliminary observations on CO-CO_2 kinetics in the first loop are discussed.

8028 (BNL-NUREG—50689(Vol.2), pp 36-48) **Research and development of high temperature helium gas loops in JAERI.** Matsunaga, S. (Japan Atomic Energy Research Inst., Ibaraki); Tanaka, T.; Baba, O. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

In connection with the development of VHTR, since 1970 in JAERI four kinds of high temperature gas loops were constructed. They are OGL-1 (Oarai Gas Loop No. 1), SGL (Small-scale high temperature helium gas loop), HTGL (Large-scale high temperature helium gas loop) and a hydrogen gas loop (a secondary loop of HTGL). OGL-1 was installed in JMTR (Japan material testing reactor, thermal power of 50 MW) on October, 1976, and both the irradiation tests of graphite and fuel specimen with 50 MW were conducted successfully on June, 1977. The maximum operating temperature during the fuel irradiation test was 1000°C. SGL and HTGL were made for the study of fluid dynamics and heat transfer characteristics of a fuel and high-temperature components of VHTR.

The maximum temperature and pressure of HTGL are as same as those of VHTR. Furthermore, as a secondary loop of HTGL, a high temperature hydrogen gas loop was also constructed and operated with the inlet helium gas temperature and outlet hydrogen gas temperature of a helium/hydrogen gas heat exchanger being 1000 and 900°C respectively.

8029 (BNL-NUREG—50689(Vol.2), pp 49-56) **Study on high temperature heat transfer system, material, and tribology in high temperature and high pressure helium environment.** Kawaguchi, K.; Tokita, Y. (Nagasaki Technical Inst.). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The paper describes the research and development programme on HTGR components carried out by Mitsubishi Heavy Industries (MHI). The effort in MHI is mainly devoted to fundamental tests such as material tests, tribology tests, and thermal insulation tests. For these tests, the multipurpose helium test loop facility (pressure: 50 bar, temperature: 1000°C and flow rate: 10 g/s) has been installed in MHI, and several other types of test facilities (creep tester, creep rupture tester, low cycle fatigue tester, corrosion tester, tribometer, gas seal tester, gas/water lubricated bearing tester, and thermal insulation test facility) are under construction or in design. These facilities will be used for following studies: (a) behavior of refractory alloys and graphites in high temperature and high pressure helium environment with various impurity levels; (b) friction and wear properties of refractory alloys; (c) characteristics of gas/water lubricated bearings and shaft seals for helium circulators; (d) gas desorption properties from the thermal insulators; and (e) performance of the thermal barrier structures.

8030 (BNL-NUREG—50689(Vol.2), pp 57-70) **Safety study on VHTR thermal structure.** Okamoto, Y.; Shimomura, H. (Japan Atomic Energy Research Inst., Ibaraki). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Several structural components are being used to provide thermal shielding for VHTR high-temperature components. Reactor core, heat-exchanger, reactor vessel and piping of VHTR reactor require the use of thermal insulation systems. Thermal and structural behavior of a high-temperature insulation layer is systematically analyzed, including the case of heat deterioration caused by convection flow and depressurization accident. This problem is taken up to further the analysis by driving a steady-state and transient equation and applying several specified cases of testing condition on HTGL and other facilities in JAERI.

8031 (BNL-NUREG—50689(Vol.2), pp 71-85) **Study on hydrogen permeation through super alloys.** Narita, Y. (Ishikawajima-Harima Heavy Industries Co., Ltd., Yokohama, Japan). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The permeation characteristics of hydrogen through Inconel 617 and Incoloy 800 tube wall were investigated experimentally by means of a test apparatus which consisted of a circulating helium gas loop for hydrogen carrier and a hydrogen supplying and exhausting system. Measurements of the diffusion rate were made using the cylindrical diffuser tube. Pressure dependence of hydrogen permeation was investigated over the hydrogen pressure range from 1 to 10 ata. Permeation rate of Inconel 617 is proportional to the square root of the pressure, but Incoloy 800 deviates from that relation, because of oxide film on the surface of test tube. Data are presented for the temperature dependence of hydrogen permeation measured over the test tube temperature range of 600 to 1050°C.

8032 (BNL-NUREG—50689(Vol.2), pp 108-119) **Fundamental experiments on high temperature insulation and fluid flow in gas-cooled reactor internal.** Uenishi, A. (Hitachi Research Lab., Tokyo); Sato, T.; Kobayashi, N.; Wajima, T.; Nawata, T. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

A helium gas test loop was constructed in order to obtain some practical experience on operation of the equipment at high temperature condition. The heat transfer and flow characteristics of gas cooled reactor internals are to be obtained on this facility. The paper presents the description of the helium gas test loop and some results of experiments. From heat transfer tests on regenerative heat exchanger and cooler, effectiveness of empirical formulae concerning the heat transfer coefficient already published was clarified. Thermal conductivity tests were carried out with varying a void fraction of porous insulating material and estimation of heat loss from the hot helium gas is numerically calculated for an inner insulating concentric duct. Further, test results of fluid flow under the core support plate of VHTR are explained.

8033 (BNL-NUREG—50689(Vol.2), pp 167-180) **Microstructure, oxidation, and fracture of HTGR graphites.** Zimmer, J.E. (Aerospace Corp., Los Angeles). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The structural graphite components that support the core of a high-temperature gas-cooled nuclear reactor (HTGR) have an expected lifetime of about forty years. During this time, these graphitic materials may be exposed to various hostile environments during normal reactor operation or under abnormal conditions. From the standpoint of reactor safety, these graphite components must retain their structural integrity after exposure to such environments, and confidence in assuring their integrity may come from an understanding of the relation between the graphite microstructure and fracture behavior. Experimental and analytical-modeling techniques have been used at The Aerospace Corporation to relate successfully the thermal and mechanical properties of advanced, reentry-system graphites to their microstructure. Thus, the application of these same techniques to HTGR graphites exposed to various reactor environments may provide a better understanding of the response of these graphites to the environment and may provide a capability for predicting component lifetime as a function of the environment. This information may afford improved bases for the evaluation of reactor safety.

8034 (BNL-NUREG—50689(Vol.2), pp 181-194) **Characterization of the metal-environment interactions in corrosion and creep of structural alloys in the HTR helium environments.** Kondo, T.; Shindo, M.; Kiuchi, K. (Japan Atomic Energy Research Inst., Ibaraki). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Corrosion of Ni- or Fe-base austenitic alloys in the simulated HTR helium environment was characterized by the special roles played by a few key alloy constituents, which could be oxidized selectively by the low oxidizing helium-base environments. The problems of the internal oxidation and the loss of oxide/metal adherence in this material system was shown to be effectively combatted by proper control of such constituents. The finding of the formation of adherent Mn-Cr spinel oxide film was applied to conventional Hastelloy X to improve the material remarkably. An exploratory work on creep deformation and rupture in the same environment has recognized the synergistic actions of plastic deformation and the surface reactions. Points were made on the role of the selective diffusion of alloy constituents due to the surface reaction and the associated effects of the surface-to-volume to affect every stage of creep processes.

8035 (BNL-NUREG—50689(Vol.2), pp 195-205) **Effect of environment on the creep and rupture properties of HTGR structural materials.** Chow, J.G.Y.; Soo, P. (Brookhaven National Lab., Upton, NY). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Impurities in the helium coolant of an HTGR may significantly change the elevated temperature properties of the primary circuit structural materials when compared to a pure environment. If the properties are deleteriously affected, the design of the primary components must take this into account. The objectives of the mechanical properties program at BNL are to evaluate the effects of impure helium on the fatigue and creep properties of primary circuit metals. The emphasis and scope of the work are directed toward obtaining information to assess the safety of the reactor throughout its service life. The BNL effort to study the environmental effect on creep and rupture properties of metals is described.

8036 (BNL-NUREG—50689(Vol.2), pp 206-215) **High temperature corrosion of heat resistant alloys in high pressure helium environment.** Murase, H. (Kawasaki Heavy Industries, Ltd., Hyogo, Japan); Fukasako, N.; Kiyoshige, M.; Kita, K.; Okuda, M. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Corrosion behaviors of Hastelloy X, Inconel 617 and Incoloy 800 in 40 atg helium environment based on HTR coolant have been studied at high temperatures from 800 to 1000°C for durations up to

1500 hours. The results were compared with those obtained in the helium environment of 1 atg, the composition of which was the same as that of the high pressure helium environment. Metallographic studies on the samples near the surface were performed by means of an electron probe X-ray microanalyzer, a scanning electron microscopy and so on. The principal results are as follows: (1) weight gain increases in accordance with parabolic law. Relations between temperature and parabolic rate constant were estimated for three alloys; (2) weight gain at 40 atg for Hastelloy X is greater than that of 1 atg, while weight gains for other two alloys are not always greater than that of 1 atg, but rather smaller at the low temperatures about 800°C; (3) it seems to be no remarkable difference with regard to metallographic studies between 40 atg helium and 1 atg helium.

8037 (BNL-NUREG—50689(Vol.2), pp 216-229) **Effect of impure helium gas on high temperature strength of Inconel 617.** Mino, K.; Hattori, H.; Kitagawa, M.; Ohotomo, A.; Fukagawa, M.; Saiga, Y. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The effect of impure helium gas of 99.995% commercial purity has been studied on the creep and fatigue strengths of Inconel 617. An impure helium environment was found to lead to a faster creep rate and shorter rupture life. And the creep strength in impure helium was reduced by up to 50% at 1000°C. The specimens crept in impure helium exhibited significant decarburization, and the creep strength reduction was shown to be attributed to the decarburization. The decarburization and the creep strength reduction were prevented by controlling the impurity contents in helium. The fatigue life increased in impure helium by the ductility improvement due to decarburization. However, a significant decrease in the fatigue life was observed by a slight carburization. Helium environmental effects on the high temperature strength of Inconel 617 were explained solely in terms of decarburization or carburization and no influence attributable to oxidation in impure helium was observed.

8038 (BNL-NUREG—50689(Vol.2), pp 230-242) **Review of the high-cycle fatigue behavior of HTGR structural alloys.** Soo, P.; Chow, J.G.Y. (Brookhaven National Lab., Upton, NY). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Fatigue failure in the power industry is a potentially serious problem because of the frequently unpredictable way in which it occurs. At this time most experimental effort on reactor structural alloys has been centered on the low-cycle regime where failure typically occurs in less than 10^5 cycles. These experiments are conducted at relatively slow cycling rates under strain-controlled conditions in order to evaluate the consequences of strains induced in structures by large thermal transients such as those obtained during a reactor startup or shutdown sequence. Relatively little attention has been paid to the high-cycle fatigue area in which materials are subjected to high-frequency, high-temperature loading. Examples of such conditions are: (1) heat-exchanger tube vibration, (2) thermal fatigue induced by fluids at different temperatures mixing at piping tee joints, (3) cyclic stresses in rotating equipment such as circulator or pump shafts, (4) rapid cyclic stresses induced inside steam generator tubes by oscillating DNB (departure from nucleate boiling) regions, and (5) general vibration problems. The work at BNL is currently concerned with high-cycle fatigue testing of HTGR alloys in order to evaluate the structural integrity of various components. Among the materials being studied are those used in the steam generators, helium circulators, and thermal barrier cover plates, since the failure of these components present some of the more severe reactor safety events. Currently, testing is being performed in an air environment to establish baseline conditions, but in-helium testing is commencing now that the MTL force-convection loop has been completed.

8039 (BNL-NUREG—50689(Vol.2), pp 243-259) **Compatibility and friction behavior of heat resistant material for HTGR.** Murase, H. (Kawasaki Heavy Industries, Ltd., Hyogo, Japan); Fukasako, N.; Kiyoshige, M.; Kita, K.; Muroaka, S.; Itami, H.; Nomura, S. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Adhesion experiments were carried out on several heat resistant alloys, refractory metals, and graphite at 800 and 1000°C in helium for durations up to 1000 hr. In addition, the friction experiments were carried out on Hastelloy X, SUS 316 and ZrO_2 coated Hastelloy X at temperatures from room temperature up to 1000°C in two kinds of helium atmospheres and in air. The principal results obtained were as follows: (1) the alloys all exhibited adhesion at temperatures above 800°C; (2) graphite in contact with heat resistant alloys did not exhibit adhesion at temperatures up to 1000°C, though all the alloys were carburized; (3) in order to prevent adhesion and reaction between these materials, ZrO_2 coating was most promising; (4) friction coefficients in helium were considerably greater than those in air at a series of temperatures tested and their differences were remarkable especially at the high temperatures near 1000°C.

8040 (BNL-NUREG—50689(Vol.2), pp 269-279) **Study on material corrosion and the resultant radioactive product formation in HTR helium environments.** Kondo, T.; Shindo, M.; Suzuki, T. (Japan Atomic Energy Research Inst., Ibaraki). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The protective oxide film formed on the surface of structural metals spalls from the substrates during long time exposure to the service condition, and the operational thermal cycling can cause additional effects with thermal stresses between the oxide and the underlying metal. Appropriate control of alloy constituents was demonstrated to provide an effective means of minimizing the release of Co and Ni through oxide spallation.

8041 (BNL-NUREG—50689(Vol.2), pp 280-294) **Study of fission product transport and deposition using thermochromatography.** Tang, I.N.; Aronson, S.; Munkelwitz, H.R.; Dickey, J.M.; Growcock, F.B. (Brookhaven National Lab., Upton, NY). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

A simple band theory is proposed to describe the thermochromatographic technique with which trace quantities of semi-volatile substances present in a flowing gas may be separated on the walls of a temperature gradient tube. It is shown that the speed of a moving band of a substance becomes essentially stationary at a temperature characteristic of the heat of vaporization of the substance. The thermochromatographic technique is well suited for studying the chemical state of fission products released from heated specimens of reactor fuels into simulated HTGR environments. Data are presented for the chemical stability of CsI at high temperatures and in helium containing various oxidizing impurities.

8042 (ORNL/TM—6099) **Analytical investigation of multicavity prestressed concrete pressure vessels for elastic loading conditions.** Fanning, D.N. (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 69p. Dep. NTIS, PC A04/MF A01.

A three-dimensional finite-element analysis of a commercial high-temperature gas-cooled reactor (HTGR) was made using the finite-element code STATIC-SAP. Four loading conditions were analyzed elastically to evaluate the behavior of the concentric core prestressed concrete reactor vessel (PCRV) of the HTGR. The results of the analysis were evaluated in accordance with Section III, Division 2, of the ASME Code for Reactor Vessels and Containments. The calculated maximum stresses were found to be well within the Code-allowable values. The analysis was preceded by an evaluation of candidate computer codes using comparisons of experimental data with analytical results for the Ohbayashi-Gumi multicavity PCRV model. This vessel was chosen as a basis for comparison because of its geometrical similarity to the large multicavity PCRV and the anticipated availability of a complete set of the original experimental data. The three-dimensional finite-element codes NONSAP and STATIC-SAP were used for the analysis of the Ohbayashi-Gumi vessel.

8043 (ORNL/TM—6353) **Distribution of fission products in Peach Bottom HTGR fuel element E01-01.** Wichner, R.P.; Dyer, F.F.; Martin, W.J.; Fairchild, L.L. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 280p. Dep. NTIS, PC A13/MF A01.

The fifth in a projected series of six postirradiation examinations of Peach Bottom High-Temperature Gas-Cooled Reactor driver fuel elements is described. The element analyzed received an equivalent of 897 full-power days of irradiation prior to the scheduled termination of Core 2 operation. The examination procedures emphasized the determination of fission product distributions in the graphite portions of the fuel element. Continuous axial scans indicated a ^{137}Cs inventory of 20.3 Ci in the graphite sleeve and 8.1 Ci in the spine at the time of element withdrawal from the core. In addition, the nuclides ^{134}Cs, /sup 110 m/Ag, ^{60}Co, and ^{154}Eu were found in the graphite portions of the fuel element in significant amounts. Radial distributions of these nuclides plus the beta-emitters ^{3}H, ^{14}C, and ^{90}Sr were obtained at four axial locations of the fueled region of the element sleeve and two axial locations of the element spine. The radial dissection was accomplished by use of a manipula-

tor-operated lathe in a hot cell. In addition to fission product distributions, the appearance of the component parts of the element was recorded photographically, fuel compact and graphite dimensions were recorded at numerous locations, and metallographic examinations of the fuel were performed.

8044 Three-dimensional problems in the design of gas-cooled HTR cores with regard to thermo- and fluid dynamics. Gysler, G.; Haque, H.; Feltes, W. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). pp 94-97 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

3-dimensional thermo- and fluid-dynamic problems in HTR cores may be calculated using the modified computer program COBRA-III C. For the layout of a 3,000 MW process heat reactor in the framework of the PNP project, the following two cases were investigated: 1) Temperature profile of the gas at the core outlet; 2) flow distribution during after-heat removal.

8045 Recent findings on reflector design in HTR reactors. Petersen, K.; Singh, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung); Cords, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen); Fritz, R. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). pp 709-712 of Reaktortagung, Hannover. Sektion 5. Komponenten und Komponenten-Werkstoffe, Qualitaetssicherung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

Due to the novel fuelling principle (OTTO) in modern pebble-bed HTR-reactors, the graphite reflector in the upper core region receives a higher fast neutron dose than in the THTR reactor. The graphite material reacts with stress differences growing with time while building up secondary stresses, so that at the end of the planned operating period of 32 years of full-load operation, the front layer will show some wear. The present report describes these processes for the reflector layer receiving the highest load under the operating conditions of a 3000 MWth PNP reactor (PNP=Prototypanlage Nukleare Prozesswaerme).

8046 Ten years of successful operation of the pebble-bed high-temperature reactor. Ivens, G.; Vollmer, H.; Ziermann, E. *BBC-Nachr.;* **60**: No. 3, 105-109(1978). (In German).

The construction and ten years of operation of the AVR not only proved that pebble-bed high-temperature reactors could be technically realized but also showed excellent operating results. The knowledge acquired from the vast program of experiments and the experience with components gained over a long period of time are extremely useful for the high-temperature reactor line.

8047 Status of design studies on experimental multi-purpose very high-temperature reactor. Aochi, T.; Yasuno, T.; Yasukawa, S.; Miyamoto, Y.; Mitake, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *Nippon Genshiryoku Gakkaishi;* **19**: No. 12, 806-813(Dec 1977). (In Japanese).

Over the past years, the design studies of the experimental multi-purpose very high-temperature reactor (VHTR) plant have been conducted at Japan Atomic Energy Research Institute (JAERI). The first conceptual design was already completed in 1975. In addition to the design studies, efforts have been directed to the trial design of a large multi-purpose VHTR system, and the safety analysis of the VHTR plant. This article deals with the status of the design studies undertaken in JAERI. Following the brief description of the reactor plant, the core nuclear and thermal design, and the results of safety analysis of the fission products behaviors and the hypothetical accident are presented. Also the items of the experiments for the verification of the design data and methods are discussed.

8048 Thermal stress and heat storage capacity in sphere heated by fluid having varying temperature. Fujii, I. (Meiji Univ., Kawasaki, Kanagawa (Japan). Faculty of Engineering). *Bull. JSME (Jpn. Soc. Mech. Eng.);* **20**: No. 149, 1389-1395(Nov 1977).

This work is concerned with the thermal stress and the heat storage capacity in pebbles exposed to a fluid of which the temperature changes periodically. The industrial application of such a heated sphere can be seen in a heat exchanger of thermal-storage type used as one of the system components in power plant such as high temperature gas cooled reactor and MHD power generation. In this study theoretical analysis is performed for three different types of temperature variation in pebbles heated by fluid. The results of numerical analysis clarify the thermoelastic behaviour and heat storage capacity and it is concluded that the trapezoidal heating is the most suitable one of the three, in view of the magnitude of induced thermal stress and the efficiency of heat transfer.

8049 Study on PCRV thermal barrier for HTGR. Kakui, H.; Shimizu, T.; Nakamura, N. (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)). *Ishikawajima-Harima Giho;* **17**: No. 5, 479-485(Sep 1977). (In Japanese).

The thermal barrier, consisting of fiber blankets, cover plates, and attachments used to install them on the PCRV liner, is one of the most important components to maintain the safety of HTGR. To maintain the structural integrity of attachments against various mechanical loads (compressive force applied to install fiber blankets on liner, force due to thermal expansion of cover plates, pressure difference due to depressurization accidents, seismic force, etc.), the size of attachments is made comparatively large; accordingly, the heat loss through attachments cannot be ignored. In this study, the temperature distribution and heat loss through attachments were measured using the full-sized thermal barrier installed on the cylindrical cavity. As a result, the effects of thermal contact resistance at face contact and screw contact on heat loss appeared distinctly; hence, useful data for actual designs were obtained. The fundamental data on the thermal contact resistance were also obtained through a laboratory-scale experiment. The results of analysis of these data have proved that when this thermal barrier is used, the temperatures of the hot spots of the liner and concrete are sufficiently low as compared with their allowable maximum temperatures.

8050 Application of a neutron sensor for steam content determination. Emel'yanov, I.Ya.; Yurova, L.N.; Smolin, V.N.; Emel'yanenko, V.D.; Esikov, V.I.; Smirnov, V.E.; Shishov, V.P. *At. Energ. (USSR);* **43**: No. 3, 171-175(Sep 1977). (In Russian).

A neutron sensor is described designed to measure the density of a steam-water mixture in the mockup of a light water-cooled graphite-moderated reactor steam-generating channel. The errors of the measurements are analyzed for an organic glass-air mixture. The patterns of steam volume fraction distributions along the steam generating channel are presented for various methods of locating the channel in the loop. Such distributions are also presented for both boiling crisis and precrisis conditions. The sensor is concluded to be applicable for investigating the steam content spatial distribution in the channel.

8051 Arrangement to prevent by-pass flows through the thermal insulation of HTR reactors. Duerrfeld, R. (to Bergwerksverband G.m.b.H., Essen (Germany, F.R.)). German(FRG) Patent 2,604,178/A/. 11 Aug 1977. 7p. (In German).

In order to avoid by-pass flows through the thermal insulation of HTR reactors, crack formation in the thermal insulation must be excluded. It is therefore proposed to substitute metal foils embedded on both sides in high-temperature mortar for the well-known rigid steel sheets (at right angles to the flow direction). It is of advantage to connect the metal foils by compensation bands.

8052 Radiation effects on heat transfer in heat exchangers. I. Heat transfer in tube. Mori, Y. (Tokyo Inst. of Tech. (Japan)); Taira, T.; Watanabe, K. *Nippon Kikai Gakkai Rombunshu;* **43**: No. 371, 2670-2678(Jul 1977). (In Japanese).

A fundamental study was made on the improvement of heat transfer rate in high temperature heat exchangers used in a multi-purpose high temperature gas cooled reactor system. The intention here is to utilize heat radiation from the first wall to the second wall. Heat is then transferred to the fluid by convection from the first and the second walls. A system of concentric dual pipes and air as fluid was used for this purpose. The outer pipe (first wall) was heated by electricity. The method of experiment and the results are explained in detail. Radial and axial temperature distributions were measured with varying conditions (input heat flux, Reynolds number, etc.) and the inprovement of equivalent heat transfer rate due to radiation was obtained. Theoretical analysis was also made and the results were compared with those obtained from measurement. The ranges of the outer pipe temperature and of the Reynolds number used in the experiments were, 420-480°C and 2.9×10^3 - 3.5×10^4, respectively. Main conclusions drawn from this study are that the equivalent heat transfer rate can be improved by a factor of 1.22-1.79 due to the existence of the inner pipe and that the analytical method can predict the experimental results satisfactorily.

8053 Method to minimize crack formation in pyrolytic carbon coatings. Lackey, W.J. Jr.; Sease, J.D. (to Energy Research and Development Administration, Washington, D.C. (USA)). German(FRG) Patent 2,647,972/A/. 28 Apr 1977. 13p. (In German).

The proposal deals with nuclear fuel particles for gas-cooled high-temperature nuclear reactors and aims to reduce the number of damaged particles in which crack formation occurs in the dense pyrolytic carbon layer and fission products thus exit from the inner part of the spherical particles. According to the invention, the coated particles, should be annealed immediately after stripping the

dense pyrolytic carbon layer, i.e. be subjected to a heat treatment at 1600°C to 2000°C without cooling before the annealing stage.

8054 Steam generator. Hunt, P.S.; Elliott, J.P.; Gulich, J.F.; Weber, J.F.; Weber, M.H.; Yampolsky, J.S.; Lockett, G.E. (to General Atomic Co., San Diego, Calif. (USA)). German(FRG) Patent 2,644,196/A/. 14 Apr 1977. 19p. (In German).

The suggestion concerns an improved construction of a steam generator suitable for gas-cooled nuclear reactors. According to the invention, the steam generator is installed in the cylindrical cavity of the pressure vessel, and the length of its pipelines is minimized. It can be taken apart which simplifies its production and shipping. Its construction involves internal crossings between the steam generating and the afterheater sections. The construction is shown in detail.

8055 Tight joint for fuel elements of a gas cooled nuclear reactor. Peehs, M.; Rau, P.; Huenner, M. (to Kraftwerk Union A.G., Muelheim an der Ruhr (Germany, F.R.)). German(FRG) Patent 2,538,192/A/. 3 Mar 1977. 9p. (In German).

An improvement on the tight joint between the reactor core supporting plate and the fuel elements hung up in its boreholes of a gascooled nuclear reactor is suggested. It concerns the design of the head-piece of the fuel element and is to render the tight joint of the fission gas in the fuel element head-piece and the supporting plate independent of the precision of the system's surfaces. Supporting elements are thus provided as well as a special geometric structure of the opposing surfaces.

8056 Method to fabricate block fuel elements for high-temperature power reactors. Hrovat, M.; Wolff, W.; Hackstein, K.G. (to Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)). German(FRG) Patent 2,207,011/C/. 3 Feb 1977. 2p. (In German).

The block fuel elements fabricated according to the main patent 21 04 431 for gas-cooled high-temperature nuclear power reactors consist of a graphite block into which coated fuel particles are firmly pressed. According to the invention, the manufacture of such fuel elements is improved on by directly pressing the cooling channels of the block element as well so that one needs no mechanical supplementary work.

8057 Spherical fuel element for high temperature reactors. Rachor, L. (to Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)). German(FRG) Patent 1,514,292/C/. 3 Feb 1977. 3p. (In German).

In order to increase the mechanical resistance of spherical fuel elements for HTR power reactors, the graphite body which is filled with loose-packed fuel or fertile particles must be as closed as possible, with only a few small openings. According to the invention, there are separate cavities inside the spherical body which can be filled with fuel or fertile material through a common gap closed with a plug.

8058 Nuclear power plant: concept to startup. Haboush, A.L. (General Atomic Co., San Diego, CA). pp 5.47-5.56 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Information on the Vrain Reactor is presented concerning design characteristics, construction procedures, testing program, and reactor start-up.

8059 High-temperature gas-cooled reactors. Peinado, C.O. (General Atomic Co., San Diego, CA). pp 5.87-5.101 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Design and operating characteristics of HTGR type reactors are presented. Major components and systems are described.

8060 Heat exchanger. Brunner, A. (to Sulzer Bros. Ltd., Winterthur (Switzerland)). German(FRG) Patent 1,501,618/C/. 6 Mar 1975. 6p. (In German).

The construction of this heat exchanger will avoid the disadvantages of the conventional constructions, which are listed in detail, in particular with regard to material and space requirements. The heat exchanger, which is especially suitable for gas-cooled reactors, consists of a number of similar elements, preferably with rectangular configurations, arranged side by side. These elements in the shape of boxes which are open top and bottom have the gaseous cooling medium flowing through them which transfers the reactor heat to the pipe coils lying at right angles to the flow direction. These elements are installed for this below the cove of the reactor in the downward current of the cooling medium. Between the sides of the vertically situated elements there are extension gaps for the absorption of heat expansion over the whole height. According to invention these extension gaps contain blocking elements on several levels and openings in the sides of the elements which create a gap. Graded pressure reduction of the first medium is achieved by means of the thus created chambers and canals over the height of the elements avoiding an otherwise necessary strengthening of the element walls. A better balance of temperature inside the elements is also brought about by means of the partial cross current of the cooling gas.

POWER REACTORS, NON-BREEDING, OTHERWISE MODERATED OR UNMODERATED

REFER ALSO TO CITATION(S) 7974, 8208, 8209

8061 Optimum burnup distribution in a continuously fueled reactor. Wight, A.L. (Atomic Energy of Canada Ltd., Mississauga, Ont.); Girouard, P. *Nucl. Sci. Eng.;* **68**: No. 1, 61-72(Oct 1978).

The Canadian Deuterium-Uranium (CANDU) pressurized heavy water reactor is fueled continuously at power, with alternate channels being fueled in opposite directions (continuous bidirectional fueling). The rate at which channels are refueled in various regions of the core determines the burnup distribution in the core. The burnup distribution in the core determines the power distribution. In present practice, the core is divided radially into two burnup regions having constant average discharge burnup. The limit on maximum neutron flux and the requirement for a critical system determine the size of the inner burnup region and the values of the burnups in the two regions. The core average exit burnup can be increased by allowing the burnup distribution to vary continuously rather than being regionwise constant. The purpose of this analysis is to derive an optimum burnup distribution that will maximize core average discharge burnup subject to a limit on maximum flux. This is equivalent to minimizing the total fuel feed rate. A set of equations describing the optimum distribution of burnup has been derived using calculus of variations techniques. These equations have been solved numerically in one-dimensional cylindrical geometry for homogeneous cores of approximately the size of current generation CANDU reactors.

8062 EDC puts up $300 million for Korean nuclear project. *Mod. Power Eng.;* **72**: No. 1, 46-47(Jan 1978).

Some general information on the Wolsung project includes financing, major contractors, a future indigenous fuel spply, and how the project fits into the Korean program. A tidal power plant on the west coast is a future possibility.

8063 Work moves into high gear at Cordoba nuclear project. *Mod. Power Eng.;* **72**: No. 1, 34-35(Jan 1978).

Some general information on Canada's sale of a CANDU nuclear reactor to Argentina is provided, with mention of uranium supply, heavy water production, contractors, and the place of the Cordoba reactor in Argentina's total program. Also mentioned are possibilities for Canadian trade in hydroelectric equipment and industrial projects.

8064 Outline of design, manufacturing and installation experience of pressure vessel structure for the prototype heavy water moderated boiling light water cooled reactor 'FUGEN'. Shibato, E.; Oguchi, I.; Kishi, T.; Kitagawa, Y. (Hitachi Ltd., Ibaraki (Japan). Hitachi Works). *Hitachi Hyoron;* **26**: No. 8, 245-250(Aug 1977).

After component installation completed in June 1977 and various functional tests to be conducted later, the prototype heavy water moderated, boiling light water cooled reactor "FUGEN" is scheduled to reach first criticality in March 1978. Since the pressure vessel of "FUGEN" is completely different from that of a light water reactor in structure and materials, through research and development work was carried out prior to fabrication and construction. Based on these studies, installation of the actual pressure vessel was completed. Functional tests are now under way. This article describes examples in which our research and development results are reflected on design, manufacture, and installation of the pressure vessel. Also it introduces noteworthy achievements relevant to production techniques in manufacture and installation.

8065 Manufacture and installation of reactor auxiliary facilities for advanced thermal prototype reactor 'Fugen'. Kawahara, T.; Matsushita, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). *Doryokuro Giho;* No. 23, 32-46(Aug 1977). (In Japanese).

The facilities of reactor auxiliary systems for the advanced thermal prtotype reactor "Fugen" were manufactured in factories since 1972, and the installation at the site began in November, 1974. It was almost completed in March, 1977, except a part of the tests and inspections, therefore the outline of the works is reported. The ATR "Fugen" is a heavy water-moderated, boiling light water reactor, and its reactor auxiliary systems comprise mainly the facilities for handling heavy water, such as heavy water cooling system, heavy water cleaning system, poison supplying system, helium circulating system, helium cleaning system, and carbon dioxide system. The poison supplying system supplies liquid poison to the heavy water cooling system to absorb excess reactivity in the initial reactor core. The helium circulating system covers heavy water surface

with helium to prevent the deterioration of heavy water and maintains heavy water level by pressure difference. The carbon dioxide system flows highly pure CO_2 gas in the space of pressure tubes and carandria tubes, and provides thermal shielding. The design, manufacture and installation of the facilities of reactor auxiliary systems, and the helium leak test, synthetic pressure test and total cleaning are explained.

8066 **High gradient magnetic filters for boiler water treatment.** Harland, J.R.; Nichols, R.M. (Sala Magnetics, Inc., Cambridge, MA). pp 193-196 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

Heavy metal oxide suspended solids in those steam condensates recycled to the boilers produce buildup within the boiler tubes which can lead to unequal and reduced heat transfer efficiency, and indirectly, to boiler tube failures. Recommended reductions in such suspended solids in feedwater to the economizers of modern high pressure boilers to levels of under 10 ppb have been published. The industrially-available SALA-HGMF magnetic filter has achieved these desired suspended solids levels in treating steam condensates. The high gradient magnetic filter has been shown in pilot tests to achieve and even exceed the recommended low level suspended solids in a practical and efficient industrial system. Such electromagnetic filters, when combined with good system chemistry, have achieved low single number parts per billion levels of several heavy metals with very high single-pass efficiencies.

8067 **Reactor.** Kurihara, K.; Natori, H. (to Hitachi Ltd.). Japanese Patent 1977-115,990/A/. 26 Mar 1976. 4p. (In Japanese).

The object of the invention is to provide a pressure tube having its inner surface formed with projections along an axial direction thereof to improve a neutron economy and relieve a thermal restriction. A pressure tube has its inner surface formed with projections along an axial direction thereof in suitably spaced relationship. Further, a fuel assembly is inserted into the pressure tube. A spacer supporting rod is placed in the outermost portion of the fuel assembly. Since the projections on the pressure tube and the spacer supporting rod remove extra coolant between the fuel rods in the outermost periphery, sectional area of coolant per fuel can be made identical to that of the fuel rod in the inner layer. Accordingly, a peaking factor of local power becomes small to improve thermal restriction. Thus, the spacer supporting rod is displaced from the central portion of the assembly to the outer periphery so that an additional fuel rod may be mounted in the central portion, thus enhancing the neutron economy.

8068 **Reactor.** Takeda, R.; Yamamoto, M.; Takeda, T. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1977-101,391/A/. 19 Feb 1976. 4p. (In Japanese).

A method is described to provide a reactor, excellent in fuel economy, high in average power density of core, and high in stability. About 90% of energy emitted from a fuel assembly is imparted to a light water coolant flowing in a pressure tube, boiling water is divided into steam and saturated water in a drum, and the steam passes through a turbine via piping and returns through a pipe to the drum. On the other hand, about 6% of power is imparted to a heavy water moderator and circulates in a loop comprising a circulation pump, a heat exchanger, and a pipe. If the flow rate of the circulating pump is made variable, the amount of voids may be controlled.

8069 **Nuclear fuel element.** Hosokawa, T.; Mori, R. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1977-100,074/A/. 18 Feb 1976. 6p. (In Japanese).

A method to prevent fuel element failure due to pellet-cladding interactions during on-power refueling is described. A region, of which outside portion has a nuclear fuel with an burnable poison, Gd_2O_3, added thereto, is provided to form a fuel pellet. This fuel pellet comprises a nuclear fuel rod charged into a cladding tube. A thermal neutron is absorbed due to the provision of Gd_2O_3 on the outside of the fuel pellet, a thermal neutron flux within the fuel pellet is greatly decreased, and a fission area of the nuclear fuel also decreases to reduce heat generation.

POWER REACTORS, BREEDING

REFER ALSO TO CITATION(S) 8242, 8261, 8269, 8271, 8276, 8277, 8281, 8282, 8284, 8285, 8287, 8288, 8295, 8306, 8398, 8598, 8602, 9315

8070 (ANL-CT—78-43) **Hydrodynamic forces on a group of tubes subjected to crossflow.** Chen, S.S.; Lin, W.H. (Argonne National Lab., IL (USA)). Jul 1978. Contract W-31-109-ENG-38. 63p. AT.

A complete solution to the problem of crossflow-induced vibrations of tube banks is still unattainable. The major task is the characterization of flow noises and motion-dependent forces. This includes the understanding of formation of organized vortex systems, unsteady fluid forces acting on the tubes, turbulence characteristics within tube arrays, and interaction of tube motion and fluid field. The objective of this report is to present a two-dimensional, potential-flow solution for the fluid inertia force, hydrodynamic damping force, and fluidelastic force of tube arrays arranged in an arbitrary pattern. Based on the result, a mathematical model for crossflow induced of tube banks is presented.

8071 (CONF-780622—67) **Design applications of irradiation creep and swelling data.** Boltax, A.; Foster, J.P.; Kalinowski, J.E.; Swenson, D.V. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). 1978. Contract EY-76-C-02-3045-007. 20p. Dep. NTIS, PC A02/MF A01.

From ANS annual meeting; San Diego, CA, USA (18 Jun 1978).

Recently, high dose irradiation creep and swelling data have been reported for a variety of stainless steels. However, the data base is still not sufficiently large for any one material to permit unambiguous determination of the functional dependencies of irradiation creep and swelling on dose, temperature, and stress. The purpose of the paper is to present an assessment of irradiation creep and swelling relative to various design applications and, in particular, to illustrate the sensitivity of uncertainties in the available data when applied to design calculations where irradiation creep and swelling act in opposition.

8072 (COO—2245-42TR) **Pressure drop measurements in LMFBR wire wrapped blanket assemblies.** Chiu, C.; Hawley, J.; Rohsenow, W.M.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA)). Jul 1977. Contract EY-76-S-02-2245. 77p. Dep. NTIS, PC A05/MF A01.

In this experiment, measurements of subchannel static pressure for an interior and edge subchannel were taken at two elevations in two wire-wrapped 61-pin bundles. One of the bundles has geometric characteristics of $P/D = 1.067$ and $H/D = 8.0$ (4 inch lead length and 0.501 inch rod diameter) and the other bundle has geometric characteristics of $P/D = 1.067$ and $H/D = 4.0$ (2 inch lead length and 0.501 inch rod diameter). The bundle average friction factors as well as the local subchannel friction factors for both interior and edge subchannels were determined from the experimental static pressure data. The average subchannel flow rates for both edge and interior subchannels were determined in a separate experiment. Results show that two correlations suggested by Rehme and Novendstern for the bundle average friction factor cannot predict the data within the range of experimental error. The bundle average friction factors for both bundles under test were underestimated by Rehme's correlation and overestimated by Novendstern's correlation. The results of the local subchannel friction factors indicate the effect of the wire lead length is more pronounced in the interior subchannel friction factor than in the edge subchannel friction factor. As the wire wrap lead length decreases, both interior and edge subchannel friction factors increase.

8073 (ESG-DOE—13239) **Sodium technology and cover gas seal development programs. Quarterly technical progress report, April—June 1978.** Welch, F.H.; Steele, O.P. III; Hill, E.F. (Atomics International Div., Canoga Park, CA (USA)). 15 Aug 1978. Contract EY-76-C-03-0824-001. 30p. AT.

Progress is reported in the LMFBR seal test program and in sodium removal and decontamination of components.

8074 (ETEC—78-10) **Sodium—water reaction test in LLTR. Series I. Final report.** Eichelberger, R.L. (Energy Technology Engineering Center, Canoga Park, CA (USA)). 15 Jul 1978. Contract EY-76-C-03-0700. 247p. TIC.

Portions of document are illegible.

Extensive large-leak testing is being conducted to investigate effects of sodium-water reaction events in LMFBR steam generators. The general objectives of the program are to provide data for validating analytical design methods, to provide data on secondary failures, and to provide performance data on ancillary and cleanup systems. The first test series, utilizing the Atomics International Modular Steam Generator as the test article, has been successfully completed and is reported. For this series, two double-ended guillotine (DEG) tests were conducted in the vertical section of the steam generator and four DEG tests were conducted in the horizontal (hockey-stick) region. The first five tests were DEG ruptures of a standard steam generator tube. The sixth test rupture tube had a flow area equivalent to three standard tubes. Results from these six tests have indicated that analytical methods are conservative (i.e., predict higher reaction temperatures and pressures than measured). Salient tests results are presented as well as comparisons between the six tests performed. The inspection activity was successful in identifying the consequences of a major sodium-water reaction event. Among

the notable observations were: secondary tube wastage, secondary tube bowing, reaction product deposition, and rupture relief characteristics.

8075 (GEFR—00373) **Intermediate System Mockup Loop (ISML) operation.** Hampton, L.V.; Kanoh, S. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). Jun 1978. Contract EY-76-C-03-0893-031. 53p. AT.

The Intermediate heat Transport System (IHTS) of the Clinch River Breeder Reactor (CRBR) will experience carbon transport from the low alloy ferritic to the stainless steels. Loss of carbon will weaken the low alloy steel and the resulting carburization may embrittle the stainless steel. The ISML test facility was constructed to model the carbon transport that will occur during the 30-year CRBR lifetime. The ISML simulates the materials, temperatures and surface area ratios of the CRBR. The objective of the tests performed is to provide the data base needed to design and predict the performance of components and piping associated with the CRBR Intermediate Heat Transport System. This report describes the ISML history to over 11,000 hours operating time.

8076 (NUREG/CP—0004(Vol.1), pp 85-99) **Zero-power basis of fast reactor dosimetry.** Sanders, J.E. (Atomic Energy Establishment, Winfrith, Eng.). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Predictions of reaction rates, atomic displacements, and gamma-ray energy deposition in the Prototype Fast Reactor are based on cross-section data and calculation methods validated against the results of zero-power experiments. The paper reviews work in Zebra relevant to this dosimetry, including neutron spectrometry, power mapping, foil activations within core heterogeneities, and measurements with thermoluminescent detectors. Comparisons of experiment and calculation are discussed in relation to the accuracies required to meet materials testing objectives.

8077 (NUREG/CP—0004(Vol.1), pp 313-320) **Selection of fission product monitors for the determination of burnup for fast reactor fuels.** Maeck, W.J. (Allied Chemical Corp., Idaho Falls, ID). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The criteria for the selection of fission monitors for the determination of nuclear fuel burnup are reviewed. A system of comparing fission yields to aid in the selection of the most promising fission monitor is presented. Based on this review, it is apparent that no single nuclide will serve as a universal fission monitor, and that different monitors are preferred for different fuel types. For FBR plutonium fuels, the use of ^{143}Nd as a fission monitor appears preferred compared to other neodymium isotopes.

8078 (NUREG/CP—0004(Vol.1), pp 321-331) **Nuclear measurements for the irradiation of GCFR-fuel elements.** Euringer, H.; Krug, W.; Schneider, W.; Stechemesser, H. (Kernforschungsanlage, Juelich, Ger.). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The essential aim of irradiation experiments in the He Loop Mol started up this year in the BR2 Mol is the investigation of release from vented fuel bundles for a GCFR. Here is described the assessments and calibrations of different types of release measurements necessary to characterize the release behavior of this species of fuel irradiation, together with the neutron fluence monitoring for the birth rate determination. The gross activity swept into the Separator System is monitored continuously. The fission product gases are measured on-line. The device taking up gamma-ray spectra if desired must be capable to measure over a wide span of gas activities. This is necessary since the loop is designed to work also under conditions of restricted defects, e.g., in the fuel rods. Furthermore tritium measurements are necessary, for studying of its diffusion behavior. Liquid scintillation counting is provided for these measurements according to a special sampling rhythm to inform on the tritium build-up in the different parts of the loop. In the cooling circuit J-131 must be traced especially because of its low permissible activity limit and diffusion behavior. For this aim a bypass line with a charcoal filter has been installed there. Besides neutron fluence monitoring, the neutron spectrum will be determined using a set of activation detectors. For evaluation by means of the unfolding code SAND-MX 2 one will start with a DTF-IV input spectrum.

8079 (ORNL—5440) **Nondestructive testing development program. Quarterly progress report for period ending June 30, 1978.** Hill, M.R. (comp.). (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 89p. AT.

Nondestructive testing (NDT) research related to LMFBR materials and components testing is reported. Included are NDT techniques and equipment for inspection and monitoring of steam generator tubes and welded joints, sodium rupture discs, and DNB water tubes. NDT methods employing ultrasonics, radiography, and eddy currents are discussed.

8080 (TID—28758) **Prototype Large Breeder Reactor: Phase II extension. Volume I. Conceptual design studies.** (Bechtel Corp., San Francisco, CA (USA)). Sep 1977. Contract EY-76-C-03-1144. 411p. AT.

The document is a compilation of work sponsored by the Energy Research and Development Administration (ERDA) as an extension of the work done during Phase II of the ERDA/Electric Power Research Institute (EPRI) Prototype Large Breeder Reactor (PLBR) study. The objective of this Phase II extension was to investigate key engineering problems generic to the balance-of-plant for the loop concept which were identified during the Phase II effort. Volume I presents the results of the following investigations: (1) piping seismic restraint design for intermediate sodium piping between buildings (BTR-9), (2) containment building structural concept study (BTR-11), (3) heat transport system piping reliability enhancement study (BTR-12), (4) minimization of seismic loadings on components (BTR-13), and (5) heat transport cell liner design requirements (BTR-14).

8081 (WARD-NC—3045-2) **Loop heat capacity models and their effects for DEMO natural circulation transient analysis.** Planchon, H.P.; Laster, W.R. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). Sep 1978. Contract EY-76-C-02-3045-034. 185p. AT.

As part of the DOE Applied Technology Breeder Reactor Natural Circulation Verification Program, improved computer models for the piping, IHX plena, and pump heat transport have been developed and/or adapted for incorporation in DEMO. The improved models include the fluid to surrounding structure heat transfer. Comparisons of the model's calculations with closed form solutions were made for verification. An assessment of the effect of the fluid to structure heat transfer on the calculations of natural circulation and normal trip transients for the CRBRP configuration, for example, indicate the following: (1) The sodium to structure heat transfer is important when calculating natural circulation thermal heads and flows. The maximum core hot spot temperature immediately following the transition to natural circulation was 20°F higher with loop to sodium heat transfer. Thereafter the heat transfer tends to smooth thermal head and flow variations and reduce peak temperatures. (2) The sodium to structure heat transfer significantly mitigates thermal transients introduced at the reactor, IHX or steam generator. For example, the rate of decrease of temperature at the superheater inlet is reduced by a factor of $^1/_2$ by the loop heat transfer following a trip to pony motor flow. The mitigation is larger for lower flows and longer pipe runs.

8082 (ANL-Trans—1140) **DISTAV calculation code for determining sodium temperatures in deformed helicoid wire pin bundles in fast neutron reactors.** Leteinturier, D.; Dufour, P.; Eyriey, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France); Societe ORDINA, 13 - Marseille (France)). Aug 1978. Translation of Paper NR-7. (CONF-780805—7). 18p. Dep. NTIS, PC A02/MF A01.

From 6. heat transfer conference; Toronto, Canada (7 Aug 1978).

The DISTAV (distribution of temperatures in an assembly during its lifetime) code is described. The code calculates sodium and pin sheath temperatures in a fast neutron reactor assembly which has been subject to deformations under irradiation is presented. The preliminary results obtained with this code are discussed and the experimental program required for its validation is described.

8083 **Conduction centrifugal electromagnetic pump.** Bonciani, L.; Grassi, W. (Pisa Univ. (Italy)). *Energ. Nucl. (Milan);* **25**: No. 2, 92-102(Feb 1978).

After a general introduction on the characteristics of conduction and induction electromagnetic pumps, the model of a particular type of conduction centrifugal electromagnetic pump is at first illustrated; a simplified theory of the pump operational principle is then given, as well as a relation between pump head and capacity. Working at null capacity is also described from both the theoretical and experimental viewpoints.

8084 **Measuring fluid pressure.** Lee, A.S. (to English Electric Co. Ltd.). British Patent 1,499,100/A/. 25 Jan 1978. 5p.

A method and apparatus are described for measuring the pressure of a fluid having characteristics that make it unsuitable for

connection directly to a pressure gauge. The method is particularly suitable for the periodic measurement of the pressure of a supply of liquid Na to Na-lubricated bearings of pumps for pumping Na from a reservoir to the bearing via a filter, the reservoir being contained in a closed vessel containing an inert blanket gas, such as Ar, above the Na.

8085 Aim, construction and operation of the fast-breeder nuclear power station in Kalkar (SNR-300). Schoenig, R. *Braunkohle;* **30**: No. 1, 11-19(Jan 1978). (In German).

From Lecture during the 43rd meeting of the DEBRIV committee Feuerungstechnik und Waermewirtschaft; Koeln, Germany, F.R. (21 Oct 1977).

After many years of research and development work the governments of the Federal Republic of Germany, Belgium and Holland decided in 1972 to promote the construction of a prototype power plant with a sodium-cooled fast-breeder reactor with an electrical capacity of approx. 300 MW. Experience is to be gained with this plant in order to determine in how far this type of reactor can be used for the commercial generation of power. The FBR can contribute on the one hand to closing the energy gap becoming apparent in the future and on the other hand to ensuring some 60 times better utilisation of existing U reserves. Furthermore, it also offers an important contribution to solving the depollution problem as it not only converts the U^{238} - which is a non-fissionable matter in LWR and which occurs to about 99% in natural U - into fissile Pu, but also uses the Pu generated in the reactors, removing it from the ecological cycle. All tests have shown that the FBR has been mastered according to present-day engineering standards and that the operation of FBR brings no increased dangers for population or environment compared with other types of nuclear power stations. The construction of the prototype power plant in Kalkar has begun in 1973. It is expected that it will be completed and commissioned by 1983.

8086 Temperature fluctuation of sodium in annular flow channel heated by single-pin with blockage. Miyazaki, K.; Kimura, J.; Ogawa, M.; Okada, T. (Osaka Univ., Suita (Japan). Faculty of Engineering). *J. Nucl. Sci. Technol. (Tokyo);* **15**: No. 1, 10-23(Jan 1978).

Root mean square (RMS) value and power spectral density (PSD) of temperature fluctuation were measured with use of forced-circulating sodium in an annular channel (6.5 mm I.D., 20mm O.D.) with concentric disk to simulate blockage (about 80%) of sodium flow. The experimental range of the heat flux was 40 -- 150 W/cm^2 and the bulk flow velocity 0.14--0.41m/sec ($Re=7.7x10^3$--$2.3x10^4$) under a temperature of 500--800°C. The RMS value measured at the exit of heating section (150mm downstream from the blockage) is larger by a factor of 2 -- 3 than that in the wake (10 -- 20mm downstream from the blockage), marking a few deg.C for a heat flux of $105W/cm^2$ and a flow velocity of 0.27m/sec. The RMS value is proportional to the wall-to-bulk-fluid temperature difference in heat transfer, presenting the similar dependence on the heat flux and flow velocity. The fluctuations of temperature are greatly attenuated in the upper unheated section where the radial temperature gradient is absent, and consequently it is suggested that the fluctuations of temperature should be caused by the local turbulence of flow, such as a vortex street due to blockage in the present experiment, under the presence of large gradient of temperature near the heating surface.

8087 Flow and mixing conditions in the upper plenum of the SNR 300. Benemann, A.; Granner, N.; Penny, W.; Schmidt, H.; Voj, P. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). pp 126-129 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

The sodium-cooled nuclear reactor is characterized by a relatively large upper tank plenum within which phenomena of energy and material transport determine the temperature and velocity distributions in the hot legs of the primary loop. During steady-state as well as transient loads this flow volume has the function of a mixing chamber for homogenizing the flow conditions and the sodium temperatures. Decisive for the mixing process are the different forces acting on the mass transport respectively the relations between them. During transient phenomena with greatly changing density conditions pressure gradients, forming on account of the differential densities, possibly may not be reduced because of the inertia forces of the flow, thus subvolumes of the upper plenum not taking part any more in the mixing process.

8088 Theoretical interpretation of boiling phenomena in electrically heated, sodium-cooled 7-rod arrays. Bottoni, M.; Struwe, D. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Reaktorentwicklung). pp 154-157 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

After describing the experimental boundary conditions their theoretical simulation is explained. Then theoretical and experimental results are compared.

8089 Experimental evidence of the effect of peripheral obstructions on the temperature from factor of a spiral wire bundle. Cornet, G.; Lamotte, G.; Verbiest, R. (Societe Belge pour l'Industrie Nucleaire, Brussels); Heinecke, J. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). pp 114-117 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978).

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

The above experiments show that - for geometry conditions (mainly pin diameter and pin pitch) typical of the SNR-300 Mk-II core - the introduction of filling wires at the periphery of the bundle leads to improvements of the temperature form factor.

8090 Primary circuit thermal hydraulic analysis of Super Phenix 1 Reactor; sodium and structures temperatures calculations; salt water tests - hot water tests. Kung, J.P.; Lambert, J. (Novatome Industries, 92 - Le Plessis Robinson (France)); Taillifet, D. (Electricite de France, 78 - Chatou. Lab. National d'Hydraulique); Ladet, J.; Gesi, E.; Marechal, A.; Vidil, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). pp 122-125 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978).

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

In the case of SUPER-PHENIX, in view of both the difficulties involved in the apprehension of sodium temperatures under turbulent flow conditions, with forced, natural or mixed convection and the lack of accurate data on the characteristics of certain stainless steels at temperatures between 500°C and 600°C, it is clear that extensive means of investigation must be developed, including both computer programs and test facilities. Present results would tend to indicate that the choice of a double vessel system, using two vessels separated by a sodium filled cavity acting as a buffer between the hot and cold collectors, would provide a satisfactory solution from the technological viewpoint. With this type of set-up, the inner vessel acts essentially as a heat shield whereas the outer vessel bears the weight of the surrounding structures: It is required to withstand certain primary stresses but remains relatively cool.

8091 Experimental determination of local temperature field variations due to spacer grids in the cladding tubes of a rod cluster flowed through by sodium. Moeller, R.; Tschoeke, H. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Reaktorbauelemente). pp 110-113 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

If spacer grids are used to keep the fuel rods in their places - as in the fuel elements of the SNR series, exact tests are necessary to find out whether and to what extent temperature peaks near the supporting points affect cladding tube design. To clarify this special problem, experimental investigations have been carried out for the first time in a rod cluster model of the SNR-300 fuel element cross-flowed with sodium. The investigations and findings so far are reported on.

8092 Alternative breeder reactor technologies. Spinrad, B.I. (Oregon State Univ., Corvallis). *Annu. Rev. Energy;* **3**: 147-179(1978).

The significance of employing breeder reactors to stretch the world resources of nuclear fuels is briefly discussed, and the various types of breeder concepts are described. General descriptions, advantages, and disadvantages of the liquid metal cooled fast breeder, gas cooled fast breeder, molten salt breeder, thermal breeders, and spectral-shift control reactors are presented. Aspects of safeguarding fissile material connected with breeder operation are examined. 31 references. (HDR)

8093 Thermo-hydrodynamic instability test for 0.3 MWt sodium-heated steam generator. Harada, T.; Tomita, Y.; Yano, T. (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)). *Ishikawajima-Harima Giho;* **17**: No. 6, 558-565(Nov 1977). (In Japanese).

In order to obtain information respecting the water-side instability in sodium-heated steam generators, the conditions to induce the instability were investigated on a 0.3 MWt test model. Firstly, the model was confirmed to be entirely stable for the range of normal operating conditions. Secondly, it was judged from the

oscillation characteristics of the flow instability that the instability was due to density wave oscillation. Thirdly, through a series of experiments where the flow instability was forcibly induced by throwing open the inlet orificing valve widely, the data for the steady-state static heat transfer just before the onset of instability and the data for the stability/instability threshold were obtained. Further, a computer program to predict the static performances was developed, and the heat input data thereunder computed were fed to the DYNAM Code to analyze the dynamic stability. As a result of the comparison with the experimental data for the stable operation, the DYNAM Code proved to have a fair amount of safety margin.

8094 Operation of the secondary cooling system of experimental FBR 'JOYO'. Kinoshita, M.; Takeuchi, Y.; Higashimaki, T.; Hida, K.; Hayashi, N. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)). *Mitsubishi Juko Giho;* **14**: No. 6, 948-962(Nov 1977). (In Japanese).

Development of Fast Breeder Reactors (FBR) is actively carried out in number of countries, for effective usage of uranium resources. Developed in Japan as a national project are experimental FBR "JOYO" and prototype FBR "MONJU", centered in Power Reactor and Nuclear Fuel Development Corporation (PNC). As the initial output of "JOYO", 50 MWt was adopted in application for its construction permission to the Government, granted in February 1970. The purpose of "JOYO" is to obtain experiences and solve technological problems through design, construction and operation of Japan's first sodium-cooled FBR. After completion, "JOYO" is used as an irradiation facility for development of fuels and structural materials. "JOYO" was completed in October 1974. Subsequently, function tests were from January 1975 to March 1977. It went critical on April 24, 1977. Described are the results of function tests on the secondary cooling system, including preheating test, initial purification test, performance test of pumps and vibration test of pipings.

8095 Local sodium boiling behind local flow blockage in simulated LMFBR fuel subassembly. Kikuchi, Y.; Daigo, Y.; Ohtsubo, A. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 11, 774-790(Nov 1977).

This paper deals with local sodium boiling in the downstream of a six-subchannel blockage in an electrically heated LMFBR fuel subassembly mock-up. The first series of experiments were conducted to measure temperature distributions in the downstream of the blockage under non-boiling conditions. The measured temperature rise due to the blockage agreed fairly well with the calculation by the LOCK code. The second series of experiments were performed to investigated local boiling phenomena. In the local boiling region, no flow instability was observed since the subchannels near the wrapper wall were still filled with subcooled liquid. In the nearly bulk boiling region, however, considerable upstream voiding occurred and then the inlet flow decreased, leading to final dryout. The boiling caused a considerable increase in acoustic noise intensity. The root-mean-square (RMS) noise level of approximately 20 mbar obtained in the present local boiling experiments with sodium was much higher than that (approximately 0.5 mbar) in the ordinary nucleate boiling experiments with water. The peak observed in the hertz ranges was due to the repetition of bubble formation and collapse. In the kilohertz ranges, however, resonance peaks were superposed on a smooth curve with a broad peak at approximately 7 kHz. The frequency (2.9 and 20.2 sec^{-1}) of bubble formation decreased with the increase of the bubble size at its point of maximum development. The product of the bubble frequency and the equivalent diameter was found to be constant.

8096 Fast breeder reactor and method of operation. Gratton, C.P. (to UKAEA London Office). German(FRG) Patent 1,764,112/C/. 27 Oct 1977. 4p. (In German).

A fast breeder reactor is described where the fuel and fertile material is utilized to the highest possible degree. This is achieved by removing part of the upstream fuel while moving the rest of the fuel upstream and reloading new fuel on the other side. In addition, the fertile material downstream of the blanket is removed, the upstream material is moved downstream, and the upstream blanket is reloaded with new fertile material.

8097 Method and apparatus for locating a defective tube of a liquid metal-to-water tube type heat exchanger. Schrock, S.L.; Mangus, J.D. (to Westinghouse Electric Corp.). US Patent T963,003. 4 Oct 1977. Filed date 12 Apr 1976. 4p.

Disclosed is a method and apparatus for detecting a specific leaking tube or tubes and for detecting the position of a defect within a tube in a liquid metal-to-water tube type heat exchanger, generally used in a sodium cooled nuclear reactor. Subsequent to draining of the heat exchanger a solid reaction product of the liquid metal and water forms at a leak location. Introducing an inert gas to the exterior of the tubes, creating a pressure differential across the tube wherein the interior pressure is less than the exterior pressure, and heating the tube, provide dissociation and isolation of the reaction product, which, when analyzed for chemical content, indicates which tube or tubes is defective. A heat probe apparatus which traverses the interior of the tubes may be used in the heating step, which, as a result of the speed of the dissociation process at high temperatures provides a means for detecting the specific leak location within the tube. A heat apparatus which traverses the exterior of bayonet type tubes may be used in another embodiment.

8098 Dissolution ratio of hydrogen generated by small-leak sodium-water reaction. Nei, H. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 9, 652-660(Sep 1977).

A study, both theoretical and experimental, was undertaken on the hydrogen dissolution ratio in liquid sodium, with the view of estimating the quantity of hydrogen that dissolves into sodium before reaching the free surface, following the occurrence of sodium-water reaction in a steam generator. Superheated steam was injected into the sodium in a reaction vessel of configuration simulating the steam generator. The hydrogen dissolution ratio was determined from analysis of the responses obtained on a hydrogen detector installed downstream of the reaction vessel. The hydrogen dissolution ratio was found to vary from 5 to 15% over a leak rate ranging of 3 -- 10 g/sec, as determined both from the transient response data given by the hydrogem detector and from the corresponding data obtained from tests on changes in hydrogen concentration upon complete mixture with the entire sodium inventory. A theoretical model was assumed for estimating the hydrogen dissolution ratio, which yield results in good agreement with the experimental data, in respect of the rising tendency of the dissolution ratio with decreasing leak rate and with rising sodium temperature.

8099 Construction of fast experimental reactor 'Joyo' from start of construction to criticality. Sakata, H. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). *Doryokuro Giho;* No. 23, 47-65(Aug 1977). (In Japanese).

The fast experimental reactor "Joyo" is a sodium-cooled, fast neutron reactor using mixed oxide of uranium and plutonium, the first in Japan. The purposes of its construction are to experience and solve the various technical problems expected in the constructions of the prototype reactor "Monju" and future practical reactors, and to use as the irradiation facility for developing the fuel and material for fast breeder reactors in Japan after the completion. The construction finished by the end of 1974, and the synthetic functional test was carried out for about two years thereafter. The whole installation was handed over to PNC on March 8, 1977. The reactor attained the criticality on April 24, 1977. The outline of the construction works is described. "Guidance to the structural design of sodium machinery for Joyo" was compiled, and the analysis was made according to it. Moreover, various inspection standards regarding welding, electrical machinery, fuel and others were made. The revision of the design for improving the safety and performance was made during the construction at all times. The synthetic functional test was carried out for about two years on 266 items, and subsequently, the criticality test was completed satisfactorily.

8100 Matrix heat exchanger. Fewell, T.E.; Ward, C.T. (to Energy Research and Development Administration, Washington, D.C. (USA)). German(FRG) Patent 2,647,653/A/. 28 Apr 1977. 17p. (In German).

Heat exchangers for nuclear reactors cooled with liquid metal are often of matrix construction. The invention deals with the improvement of the heat transfer behaviour of such aggregates. A small gap between the matrix and pipeline is to be filled with a liquid medium of good thermal conductivity (e.g. melted metal such as Bi, Pb, Hg or their alloys). Additions of Zr, Mg or Ti are to prevent the cooling pipe walls from corrosion. Advantageous variations of the composition and arrangement are given in detail.

8101 Breeder reactor in electricity supply. Berridge, D.R. (South of Scotland Electricity Board, Glasgow (UK)); Vernon, K.R. (North of Scotland Hydro-Electric Board, Edinburgh (UK)). pp 77-82 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

Forecasts are made of Britain's energy prospects in the year 2000. It is concluded that fossil fuels and renewable energy sources will leave an energy gap and that dependence on nuclear power will be substantial. There will, however have been a rapid depletion of readily available uranium ore reserves and a growing availability of plutonium from thermal reactors. Britain's resources of plutonium and depleted uranium which the fast breeder reactor can use - will equal many thousand million tonnes of coal. Our nuclear programme should therefore include one or two FBRs. Resources should be pooled internationally and plants built to prove alternative options and consolidate an already highly developed technology. In Britain our earliest nuclear (Magnox) stations have served as well. In Scotland, where next year an estimated 30% of electricity output

will be nuclear, Hunterston 'B' AGR has had a splendid first year of operation, and pumped storage capacity in Scotland has extended the benefits of low-cost generation. The FBR has many very satisfactory engineering features and is eminently controllable and well behaved. It is compact, with relatively low cooling-water requirements and it could be built, one hopes, close to our load centres. There can be confidence that it will be proved safe. An order for an FBR, on the earliest timescale that fits in with evidence of successful operation of the Dounreay PFR and an agreed international programme, would serve the national interest and ensure the survival of our plant manufacturers, so badly hit by the effects of stagnation of the U.K. economy.

8102 Dounreay Project. Blumfield, C.W. (UKAEA Reactor Group, Dounreay. Dounreay Experimental Reactor Establishment). pp 21-36 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

The paper briefly refers to the history of the Dounreay Experimental Reactor Establishment and the 18 years of safe operation of the Dounreay experimental liquid-metal-cooled fast reactor (DFR). Reference is also made to the successful commissioning of the 250 MW(e) Prototype Fast Reactor (PFR). This long history of the use of fast reactor technology has shown that although fast reactors are different in concept to thermal reactors they are as easily operated, if not more so. The experience gained from the scientific research into materials suitable for fast reactors has provided a comprehensive library of information for the design of the next phase of fast reactors. Fuel assemblies have been operated at full power with flow restricted to produce coolant boiling conditions. These have shown that the high heat fluxes of fast reactors are adequately tamed by the liquid metal coolant. Experience in commissioning the PFR has enabled the designers of the demonstration Commercial Fast Reactor to progressively deal with important issues. In particular, the boiler design, which was always considered to be difficult technological issue, has evolved to eliminate the small water leaks that have occurred in the PFR boilers. This will be tested in the PFR well in advance of its use in the demonstration Commercial Fast Reactor. Reprocessing of the PFR fuel at Dounreay will commence in about a year's time. This has involved reconstructing a plant which was used for reprocessing of DFR fuel. The decommissioning of the plant to the colloquial green field state allowed the modifications to be carried out expeditiously. The new plant has been designed on the knowledge produced in experiments to determine the most efficient and safe method of separation and waste management.

8103 Setting the scene. Curran, S. (Strathclyde Univ., Glasgow (UK)). pp 1-7 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

The reasons for the special meeting on the breeder reactor are outlined with some reference to the special Scottish interest in the topic. Approximately 30% of the electrical energy generated in Scotland is nuclear and the special developments at Dounreay make policy decisions on the future of the commercial breeder reactor urgent. The participants review the major questions arising in arriving at such decisions. In effect an attempt is made to respond to the wish of the Secretary of State for Energy to have informed debate. To set the scene the importance of energy availability as regards to the strength of the national economy is stressed and the reasons for an increasing energy demand put forward. Examination of alternative sources of energy shows that none is definitely capable of filling the foreseen energy gap. This implies an integrated thermal/breeder reactor programme as the way to close the anticipated gap. The problems of disposal of radioactive waste and the safeguards in the handling of plutonium are outlined. Longer-term benefits, including the consumption of plutonium and naturally occurring radioactive materials, are examined.

8104 Energy gap and the fast reactor. Hill, J. (UKAEA). pp 14-20 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

The background to the development of fast reactors is summarized. In Britain, the results of the many experiments performed, the operation of the Dounreay Fast Reactor for the past 18 years and the first year's operation of the larger Prototype Fast Reactor have all been very encouraging, in that they demonstrated that the performance corresponded well with predictions, breeding is possible, and the system is exceptionally stable in operation. The next step in fast reactor engineering is to build a full-scale fast reactor power station. There would seem to be little reason to expect more trouble than could reasonably be expected in constructing any large project of this general nature. However, from an engineering point of view continuity of experience is required. If a decision to build a commercial fast reactor were taken today there would be a 14-year gap between strating this and the start of the Prototype Fast Reactor. This is already much too long. From an environmental standpoint we have to demonstrate that we can manufacture and reprocess fast reacctor fuel for a substantial programme in a way that does not lead to pollution of the environment, and that plutonium-containing fuel can be transported in the quantities required in safety and in a way that does not attract terrorists or require a private army to ensure its security. Finally, we have to find a way to allow many countries to obtain the energy they need from fast reactors, without leading to the proliferation of nuclear weapons or weapons capability.

8105 International scene. Simpson, H.C. (Strathclyde Univ., Glasgow (UK)). pp 37-48 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

Six main nations or groups of nations are involved in the large scale development of Liquid Breeder Reactors, (1) the U.K., (2) France, (3) West Germany/Belgium/the Netherlands, (4) the U.S.S.R., (5) Japan and (6) the U.S.A. The prototype development programme of the last five of these groups is outlined. France with its 250 MW(e) Phenix plant has had two years of commercial service and has designed a 1200 MW(e) Super-Phenix plant. Germany, in collaboration with Belgium and the Netherlands, is building a 300 MW(e) plant S.N.R.-300 which is due to go critical by 1981. The U.S.S.R., in addition to the B.N.-350 combined power and desalination plant now in operation, is now building a 600 MW(e) plant B.N.-600 which is due to go critical by the end of 1977, and Japan has also started work on a 300 MW(e) reactor MONJU due to be completed by 1986. Finally, the U.S.A. in addition to a very large experimental programme, is constructing a 380 MW(e) fast reactor at Clinch River, expected to start up in 1982. This implies roughly 2300 MW of electrical power being produced by breeder reactors in the near future.

8106 Fuel recycling. Hunt, S.E. (Aston Univ., Birmingham (UK)). pp 53-63 of Breeder reactor. Forrest, J.S. (ed.). Edinburgh; Scottish Academic Press (1977).

From Meeting on the breeder reactor; Strathclyde, UK (25 Mar 1977).

The global nuclear power programme should be designed not only to produce electricity at the lowest possible cost, but also to make the best use of our fissile fuel reserves in the longer term. This clearly indicates the necessity of using breeder reactors, which with plutonium recycling, can achieve total fuel utilisation figures of 70% to 80% as opposed to the very small percentages available from non-breeders, even with recycling. The plutonium can be separated from spent fuel elements chemically. The United Kingdom is in a favourable situation to initiate a fast breeder reactor programme because it has appreciable supplies of plutonium accumulated from the Magnox programme, but on a global scale there is a danger that a sudden expansion of the nuclear programme based on non-breeder reactors will exhaust the supplies of commercially viable uranium before adequate supplies of plutonium have been built up to provide the cores for a significant fast breeder programme. This situation will be worse if, as seems likely, the thermal programmes are based on reactors which are poor producers of plutonium and themselves require enriched fuel. A more modest global expansion of the thermal nuclear programme to about 600,000 MW(e) by the year 2000 is possible using reasonably economic uranium reserves. If this were based on thermal reactors which were reasonably good producers of plutonium (Candu, Magnox and HTR) the programme could provide plutonium for the cores of 800, 000 MW(e) of installed fast breeder capacity by the year 2000. Thereafter, if the doubling time of the electricity demand is shorter than that of the plutonium inventory, either the gas-cooled fast breeder or a combination of thermal 'near breeders' and liquid-metal fast breeders will be required.

8107 Liquid metal fast breeder reactor. Gibson, A.S. (General Electric Co., Sunnyvale, CA). pp 5.102-5.123 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Information on LMFBR type reactors is presented concerning sodium characteristics, primary coolant circuit, reactor kinetics, design factors and safety considerations, past and present status of LMFBR reactors, fuel cycle considerations, and economic comparisons with other power sources.

8108 Gas-cooled fast breeder reactor. Simon, R.H. (General Atomic Co., San Diego, CA). pp 5.124-5.136 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Design characteristics of GCFR type reactors are presented. Information on the 300 MW(e) demonstration GCFR is presented

concerning design specifications, components, performance characteristics, safety aspects, and testing programs.

8109 Spent fuel cleaning device. Sasaki, S. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-148,799/A/. 4 Jun 1976. 3p. (In Japanese).

The object of the invention is to clean spent fuel of a fast breeder reactor safely and positively by a simple procedure. At the bottom of a cleaning tank is provided a carbon dioxide gas feeding device filled with carbon dioxide and a cleaning solvent tank for feeding lower pressure vapor is connected thereto. The spent fuel is put into the cleaning tank to clean it so that sodium adhered to the surface of the spent fuel may be cleaned while effecting reaction expressed by $2Na + 2Co_2 + 2H_2O \rightarrow 2NaHCO_3 + H_2$. On the other hand, hydrogen produced is discharged through a waste processing system, and concentration of hydrogen is maintained outside explosion of hydrogen concentration by means of dilution of rare gases.

8110 Fuel Assembly. Kato, Y. (to Hitachi Ltd.). Japanese Patent 1977-137,588/A/. 14 May 1976. 3p. (In Japanese).

The object of the invention is to prevent supports of the fuel assembly of a high-flux reactor from becoming fragile due to irradiation with fast neutrons by the provision of a neutron shield between the endless nozzle arrangement of a wrapper tube and fuel pins of the fuel assembly. A neutron shield consisting of stainless steel is provided between an endless nozzle arrangement on the outer periphery of a wrapper tube and the fuel pins of the fuel assembly. Since neutrons passing through the gap in the fuel assembly can be prevented by the shield, it is possible to alleviate excessive stress in the entrance nozzle portion produced due to warping of the fuel assembly at the time of reactor operation.

8111 Fast breeder. Miki, K.; Inoue, K. (to Hitachi Ltd.). Japanese Patent 1977-115,991/A/. 26 Mar 1976. 3p. (In Japanese).

The object of the invention is to disperse curved directions of fuel assemblies due to the difference in temperature of walls of a wrapper tube and making use of interaction of adjacent fuel assemblies to limit deformation, thereby minimizing the deformation of a core. Two kinds of fuel assemblies in which wire spacers wound about fuel pins are opposite in rotative direction with each other are alternately arranged in each layer to constitute a core. Therefore, the fuel assemblies arranged in the radial direction of the core are different in curved direction in each layer, and the amount of deforming the core in the radial direction is restricted by the adjacent fuel assemblies. As a consequence, a load imposed on the fuel assembly near the center of the core due to a compulsive reaction from a restriction mechanism around the core is less than the conventional core. It will be noted that the curved direction of each fuel assembly is determined depending on pitch of the wire spacer.

8112 Liquid-metal cooling reactor. Mitsutsuka, N.; Kubo, K.; Miyazawa, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-115,992/A/. 25 Mar 1976. 9p. (In Japanese).

The object of the invention is to quickly and positively detect a failure condition of nuclear fuel inside the reactor to enhance safety. A coolant in contact with a core partly passes through a sampling pipe, a solenoid pump, a flow meter, a tank and a pipe. When a nuclear fuel charged in a core is failed, a nuclear fission formation gas in the coolant moves into a space above said tank. This gas flows into a first and second nuclear fission formation gas detectors, and a signal is sent to a system of failed fuel detection and diagnosis. The coolant discharged from the tank flows into ^{135}I detection system and is returned to a reactor vessel. At this time, an adsorption tank is adjusted in temperature, and after a lapse of given time, the flowing of coolant into the ^{135}I detection system is stopped for detection of sup(135m)Xe and ^{135}Xe formed from ^{135}I by sup(135m)Xe detection portion and output signals from said detection portion are processed to calculate the amounts of sup(135m)Xe and ^{135}Xe, and the amount of ^{135}I in the coolant from the operation conditions of the ^{135}I detection system.

8113 Failed fuel detector in reactor. Mitsutsuka, N.; Miyazawa, T.; Kubo, K. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-104,691/A/. 27 Feb 1976. 7p. (In Japanese).

The object of the invention is not only to make the detector small, but also to increase the detection sensitivity for concentration of nuclear fission iodine. Structure: Liquid sodium, a coolant, is introduced into a gas-liquid separator through a piping at an upper portion of a reactor container, and then into an adsorption container. At this time, Xe-135m produced by disintegrating I-135 in the liquid sodium migrates to a cover gas at an upper portion of the gas-liquid separator. I-135 introduced into an adsorber is cooled to 200°C or less in a cooler and is adsorbed on an adsorbent. Flow of the liquid sodium is stopped and X-135m in the adsorbent is migrated into the cover gas by heating the adsorber to 300°C or more, as a determined quantity of the liquid sodium is extracted from the reactor container. Therefore, the cover gas is introduced into a radioactivity measuring instrument.

8114 Neutron shielding block. Goto, Y. (to Mitsubishi Atomic Power Industries, Inc., Tokyo (Japan)). Japanese Patent 1977-77,999/A/. 24 Dec 1975. 3p. (In Japanese).

A method is described to provide a neutron shielding block which does not require much space and is stable under a high temperature for a long period of time, effective for a wide neutron energy range as a local shielding material and easy to treat of induced radioactivity. The shielding block takes the form of container type. The interior of the container is divided into a plurality of sections by a partition plate, and one of the sections is filled with a thermal neutron absorber, and other sections is filled with a neutron moderator. Each section is provided with a vent hole to communicate the interior and exterior and with an air permeable cover for covering the hole.

REGULATION AND LICENSING

REFER ALSO TO CITATION(S) 7975, 8240

8115 Instrumentarium of the Federal Government for the protection of the population and environment in connection with the construction of nuclear facilities. *Umwelt (Inf. Bundesminist. Innern);* No. 60, 22-26(Feb 1978). (In German).

A survey of statutory ordinances, regulations, catalogues of rules and recommendations as well as technical rules for the nuclear licensing procedure derived from the Atomic Energy Act and the Radiation Protection Ordinance.

8116 Nuclear reactor operator licensing. Bursey, R.J. *Nucl. Saf.;* **19**: No. 5, 623-627(1978).

The Atomic Energy Act of 1954, which was amended in 1974 by the Energy Reorganization Act, established the requirement that individuals who had the responsibility of operating the reactors in nuclear power plants must be licensed. Section 107 of the act states "the Commission shall (1) prescribe uniform conditions for licensing individuals; (2) determine the qualifications of such individuals; and (3) issue licenses to such individuals in such form as the Commission may prescribe." The article discusses the types of licenses, the selection and training of individuals, and the administration of the Nuclear Regulatory Commission licensing examinations.

8117 Alteration of reactor installation in Tokai Nuclear Power Station II of the Japan Atomic Power Company. *Genshiryoku Iinkai Geppo;* **22**: No. 6, 30-32(Sep 1977). (In Japanese).

The report of the Committee on Examination of Reactor Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. The alterations are to adopt MCPR 1.19 for early-stage core, and MCPR 1.26 for end equilibrium core; as thermal limiting value, and use of the solid waste storage also for Tokai Nuclear Power Station.

8118 Alteration of reactor installation (unit 1) in Ikata Nuclear Power Station of Shikoku Electric Power Co., Inc. *Genshiryoku Iinkai Geppo;* **22**: No. 6, 36-38(Sep 1977). (In Japanese).

The report of the Committee on Examination of Reactor Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. The alterations are change to 3.28 wt % U^{235} enrichment for replacement fuel; use of burnable poison also in replacement core; and change in nuclear limiting values.

8119 Alteration of reactor installations (Units 1, 2, 3, 4, 5 and 6) in Fukushima Nuclear Power Station I of the Tokyo Electric Power Company, Incorporated. *Genshiryoku Iinkai Geppo;* **22**: No. 6, 38-41(Sep 1977). (In Japanese).

The report of the Committee on Examination of Reactor Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. The alterations are use of 8 x 8 type fuel assembly as replacement fuel in Units 4 and 5; as thermal limiting value, use of MCPR 1.26 for 7 x 7 type and 1.29 for 8 x 8 type in Unit 1, and 1.22 for 7 x 7 type and 1.23 for 8 x 8 type in early stage core and 1.24 for 7 x 7 type and 1.28 for 8 x 8 type in end equilibrium core in Units 2, 3, 4 and 5; installation of a solid waste storage common to six units and increase of tanks; etc.

8120 Alteration of reactor installation in Tokai Nuclear Power Station of the Japan Atomic Power Company. *Genshiryoku Iinkai Geppo;* **22**: No. 6, 41-42(Sep 1977). (In Japanese).

The report of the Committee on Examination of Reactor Safety to the Atomic Energy Commission of Japan concerning the alteration is given, which is attached to the reply from the commission to the prime minister, and its safety was confirmed. The alterations are to put solid wastes in the storage of Tokai Nuclear Station II, and to construct a storage for high level solid wastes.

8121 Report on the meeting for examining replacing core. *Genshiryoku Iinkai Geppo;* **22**: No. 7, 30-33(Sep 1977). (In Japanese).

At the time of examining the application for approval of reactor installation, it must be confirmed that the safety of the concerned reactor is secured with not only the initially loaded core but also the reload core. Besides, it must be confirmed again that the various criteria concerning the safety are satisfied after the start of operation, because a part of the parameters of the replacing core is dependent on the operational history. On the above described viewpoints, the main parameters affecting the safety and the nuclear and thermal limits of replacing core were reviewed. Moreover, the contents of description concerning replacing core in the application form were examined. As the general matters concerning the safety of replacing core, the scram reactivity curves for BWRs and PWRs, the method of description in the application form concerning the fuel containing gadolinia, and the use of burnable poison in replacing core were examined. The meeting for examining replacing core was organized on September 20, 1976, at the Committee for Examining Reactor Safety, and this report was compiled as the results of 10 meetings.

ECONOMICS

8122 Nuclear spotlight on South Africa. Groenewald, C. *S. Afr. Panorama;* **22**: No. 5, 8-11(May 1977).

This article discusses South Africa's nuclear policy and its objectives of and achievements in nuclear technology.

8123 Nuclear power in Asia. Stone, W.F. (China Light and Power Company, Ltd., Hong Kong). pp 743-744 of Fracture mechanics and technology. Volume 2. Sih, G.C.; Chow, C.L. (eds.). Alphen aan den Rijn, Netherlands; Sijthoff (1977).

From Conference on fracture mechanics and technology; Hong Kong, China (21 Mar 1977).

A brief review is given of the present status of nuclear power in Asia. Nuclear Power Generation was introduced to Asia in the early 60's, and a small light water reactor was commissioned in 1963 in Japan. Since then, a number of nuclear power stations have been put into operation in Japan, Pakistan, and India and by the mid 80's some 24 reactors will be in operation in Asia and this does not include the nuclear plant in Japan.

8124 Guidelines of the nuclear supplier countries for nuclear exports. Gruenewald, A. *GRS Kurz-Inf., Reihe C;* No. 5, 1-4(1977). (In German).

German text of the guidelines which were passed on to the IAEA. The FRG refrained from making addendums (like USA, UK, France, Netherlands) which take into account the specific legal situation and political conceptions.

8125 Die Atompolitik der westdeutschen Industrie und die Gruendung von Euratom. (Nuclear policies of the West-German industry and the foundation of Euratom). Deubner, C. (Konstanz Univ. (Germany, F.R.)). Frankfurt am Main, Germany, F.R.; Campus-Verl. (1977). 199p. (In German).

In this study an attempt is made to portray on the basis of numerous documents the historical development of nuclear energy in the FRG and the foundation of EURATOM in this connection, and to present the origin and the 'driving forces' of nuclear politics, particularly up till 1969. The facts claimed and the author's interpretation are influenced by party politics, they provoke a statement, and detract from a valuable and comprehensive literature compilation.

8126 Energy situation and role of nuclear power generation in Italy. Speri, G. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). *Gensan Nenji Taikai Gijiroku;* No. 10, 63-83(1977). (In Japanese).

From 10. annual conference of the Atomic Industrial Forum; Tokyo, Japan (9 - 11 Mar 1977).

The increase of electric power demand in Italy slowed down during the last several years, but the maximum load continued to increase steadily. The electrical power consumption in Italy is 2375 kwh per person in 1974, which is much less than that in Germany, England and other countries in Europe. The energy resources in Italy consists of hydraulic power generation which has the capability about 11 x 10^3 MWe in operation in 1975, thermal power generation including both steam power and gas turbine with about 19 x 10^3 MWe and 0.4 MWe, respectively, and the geothermal power generation that is a special resource in Italy with the capacity of about 1/3 in the world. Research has not been carried out in the field of tidal power generation, but solar energy is developed in Italy. ENEL has exerted its best effort to scale up the thermal power generation since 1960s with the standardization of plant capacity into 160 MWe, 320 MWe and 660 MWe. The multiformity of fuel is considered in these thermal power generating plants recently, and coal is also looked for again. As for the nuclear power generation, about 600 MWe is now in operation. It is considered about the nuclear power generation that safety and financial problems exist which are connected to the public sense of unease with no ground, the solution of social economy problem around the sites, the necessity of much funds, and the licensing problem. Much effort is concentrated in the standardization of the plants, considering safety improvement and technical development. The lead time in the construction of a nuclear power plant is very long, and it is necessary to establish the siting law, promote the technical development and secure the public acceptance.

8127 French nuclear power policy. Teillac, J. (CEA, 75 - Paris (France)). *Gensan Nenji Taikai Gijiroku;* No. 10, 16-28(1977). (In Japanese).

From 10. annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (9 - 11 Mar 1977).

The energy demand increased steadily during the last ten years in France, and the energy consumption was 165 x 10^6 t being converted to oil in 1976, and the quantity will expand 1.5 times in 1985. From this prospective view, emphasis must be placed on nuclear power generation as France has much uranium deposits. The French nuclear development program was started with natural uranium, graphite-moderated, gas-cooled reactors, which were followed by pressurized water reactors being constructed by the Framatom, and much endeavor is now made on the development of fast breeder reactors which will achieve the solution of energy problems in future. As for the fast breeder reactors, the experimental reactor Rapsodie achieved the criticality in 1967, and now in operation, and the proto-type reactor Phenix started to generate 250 MWe power since 1974, and the average load factor has been about 59% in two years. The construction of the next large reactor Super Phenix, the capacity of which is 1200 MWe, was ordered in 1976. The nuclear fuel cycle including uranium enrichment and reprocessing and the research and development on nuclear power generation being mainly conducted by CEA are also reviewed in this paper.

8128 Rapports de la Commission Consultative pour la Production d'Electricite d'origine Nucleaire, 1964-1969. (Reports from the Advisory Committee for Nuclear Power Generation. Vol. I). Paris; Documentation Francaise ([nd]). 226p. (In French).

The scheme is as follow: evolution of the electric power production and the corresponding needs in primary energy; present economic data and future outlook of conventional and nuclear power plants, the most important uncertainties that prevail regarding the technology; possible nuclear development and the difficulties that may appear in the industrial field and for supplying nuclear fuel; conclusion dealing with the priority to be given to the development of nuclear power plants in France and the Vth plan (1965-1970). Detailed elements corresponding to each items are given in appendix, the conclusions of the present report are also compared with the position adopted in Great Britain regarding nuclear programs in a 'Blanck Paper' entitled: 'The Second Nuclear Power Programme' which provides a nuclear program of 5000 MWe to be carried out for the six years nearly corresponding to the period of the Vth plan.

8129 Rapports de la Commission Consultative pour la Production d'Electricite d'origine Nucleaire 1970-1974. (Reports from the Advisory Committee for Nuclear Power Generation, 1970-1974. Vol. II). Paris; Documentation Francaise ([nd]). 226p. (In French).

The present report is first dealing with the general status or nuclear power production throughout the world and is defining more accurately the French position. It is then dealing with the various aspects of the quantitative programme based on light water reactor types for the VIth plan, its justifications, the problems involved and the importance of this programme. The various items of a subsidiary programme are presented for the reactor types, the development of which is to be examined for the future (sodium cooled fast neutron reactors, heavy water reactors involving the EL600 project, and HTRs). Two fields closely related to nuclear power realizations are discussed: the fuel cycle and the effort required in research and development .

CONSTRUCTION AND OPERATION

REFER ALSO TO CITATION(S) 8773

8130 Material- and safety-problems in the construction of power plants. *Maschinenschaden;* **50**: No. 5, 177-179(1977). (In German).

W. Schoch furnished many useful and noteworthy hints about the material- and safety-problems in the construction of power plants on the occasion of the 1976 'Great Welding Technology Convention' (6th-8th October) in Mannheim.

FUEL CYCLE

REFER ALSO TO CITATION(S) 8106

8131 (CONF-771155—P1, pp 31-45) **Nonproliferation alternative systems assessment program.** Strauch, S. Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

A brief discussion is presented of fuel cycle options which would provide increased resistance to weapons proliferation. The primary emphasis is on the once-through LWR cycle, but studies are also being made on LMFBR, GCFR, HTGR, molten salt reactors, accelerator breeders, and fusion-fission hybrids.

8132 (CONF-771155—P1, pp 47-61) **Utility perspective on fusion—fission energy systems.** Bos, P. Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

Data are presented on electric power demand estimates through the year 2020, and the possibilities for fusion-fission energy systems in meeting a part of this projected demand are examined.

8133 (CONF-771155—P1, pp 63-81) **Continued electrical power from fission.** Kouts, H. (Brookhaven National Lab., Upton, NY). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

The following possibilities are examined for stretching the nuclear fuel supply: (1) fast breeder reactors, (2) thorium cycle, (3) heavy water reactors, (4) better isotope separation, and (5) electronuclear boosting.

PROCESS HEAT REACTORS

REFER ALSO TO CITATION(S) 7560

8134 **Energy cascading in large district heating systems.** Mayer, F.W. (Inst. of Thermal Power and Nuclear Engineering, Graz). *Nucl. Technol.;* **40**: No. 3, 234-239(Oct 1978).

District heat transfer is the most economical utilization of the waste heat of power plants. Optimum utilization and heat transfer over large distances are possible because of a new energy distribution system, the "energy cascading system," in which heat is transferred to several consumer regions at different temperature ranges. It is made more profitable by the use of heat pumps. The optimum flow-line temperature is 368°K, and the optimum return-line temperature is 288°K, resulting in an approximately 50% reduction of electric power loss at the power plant.

8135 **700 + 6,5 x D or: District heat in Sweden.** *Energie;* **30**: No. 5, 158-166(May 1978). (In German).

The ENERGIE report gives a survey of the development, construction, installation, and costs of the district heat pipes used in Sweden and mentions the 'SECURE' project. This project concerns a planned underground nuclear heating power plant of about 200 MW(th) in urban regions which will be used mainly for district heat supply.

8136 **Thermal loads on the absorber rods of the PNP reactor.** Haque, H.; Gysler, G. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). pp 98-101 of Reaktortagung, Hannover. Sektion 1. Reaktorauslegung. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

For the nuclear process heat reactor, a combined control and shutdown system with torsion rods or lifting rods with free insertion into the pebble bed or withdrawal from it is planned. Insertion and withdrawal of the absorber rods in the pebble charge causes mechanical loads on the cladding tubes. For reasons of strength, a maximum cladding tube temperature of 740°C should not be exceeded. The thermal load on the absorber rods at various states of operation of the PNP reactor is studied here. The calculations have been carried out using the COBRA-IIIC programme.

NUCLEAR REACTOR TECHNOLOGY

THEORY AND CALCULATION

8137 (NUREG/CP—0004(Vol.1)) **Dosimetry methods for fuels, cladding, and structural materials.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). 1977. 498p. (CONF-771036—P1). Dep. NTIS, PC A21/MF A01.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

Separate abstracts were prepared for 20 of the 26 papers included. Separate abstracts have previously appeared in ERA from the remaining 6 papers.

8138 (NUREG/CP—0004(Vol.1), pp 1-16) **Dosimetry and shielding.** Farinelli, U. (CNEN, Rome). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Today, reactor dosimetry and shielding have wide areas of overlap as concerns both problems and methods. Increased interchange of results and know-how would benefit both. The areas of common interest include calculational methods, sensitivity studies, theoretical and experimental benchmarks, cross sections and other nuclear data, multigroup libraries and procedures for their adjustment, experimental techniques and damage functions. This paper reviews the state-of-the-art and the latest development in each of these areas as far as shielding is concerned, and suggests a number of interactions that could be profitable for reactor dosimetry. Among them, re-evaluation of the potentialities of calculational methods (in view of the recent developments) in predicting radiation environments of interest; the application of sensitivity analysis to dosimetry problems; a common effort in the field of theoretical benchmarks; the use of the shielding one-material propagation experiments as reference spectra for detector cross sections; common standardization of the detector nuclear data used in both fields; the setting up of a common (or compatible) multigroup structure and library applicable to shielding, dosimetry and core physics; the exchange of information and experience in the fields of cross section errors, correlations and adjustment; and the intercomparison of experimental techniques.

8139 (NUREG/CP—0004(Vol.1), pp 145-228) **Introduction to neutron metrology for reactor radiation damage.** Alberman, A. (CEN, Saclay, France); Genthon, J.P.; Mas, P.; Schneider, W.; Weise, L.; Wright, S.B.; Zijp, W.L. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

This document, prepared by members of the Irradiation Damage Subgroup of the Euratom Working Group on Reactor Dosimetry (EWGRD), describes the background of the procedures for determining irradiation parameters which are of interest in radiation damage experiments. The first two chapters outline the concept of damage functions and damage models. The next two chapters give information on methods to determine neutron fluences and neutron spectra. The fifth chapter gives a review of correlation data available for graphite and steels. The last chapter gives guidance on how to report the relevant irradiation parameters. Attention is given to the role of the neutron spectrum in deriving values for damage fluence, energy transferred to the lattice, and number of displacements. A suggested list to report data relevant to the irradiation, the instrumentation, and the testing of material is included.

8140 (NUREG/CP—0004(Vol.1), pp 257-269) **Neutron energy spectrum determination for irradiation damage study of reactor structural materials (No. 2).** Takeuchi, K.; Miura, T.; Yamaji, A. (Ship Research Inst., Naka-gun, Japan). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Two experiments were selected as standards of comparison for PALLAS neutron transport calculations, mocked up with iron-water configurations arranged to simulate the pressure vessel of a light water reactor. The measured spectra were obtained through the use of SAND-II based on measured values of reaction rate. PALLAS calculations of fast neutron energy spectra in the iron-water configurations result in fairly good agreement with experi-

ments. It is illustrated that the energy spectrum of displacements/atom is markedly changeable with penetration distances through iron structures, and that the neutron energy region from 0.2 to 7 MeV is very important for radiation damage to the pressure vessel of a LWR.

8141 (NUREG/CP—0004(Vol.2)) **Dosimetry methods for fuels, cladding, and structural materials.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). 1977. 487p. (CONF-771036—P2). Dep. NTIS, PC A21/MF A01.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

Separate abstracts were prepared for 22 of the 28 papers included. Abstracts for the remaining 6 papers have previously appeared in ERA.

8142 (NUREG/CP—0004(Vol.2), pp 591-625) **Neutron spectrometry for reactor dosimetry.** De Leeuw-Gierts, G.; De Leeuw, S. (SCK/CEN, Mol, Belgium). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The accuracies to be reached for the determination of reactor parameters and damage analysis implicate the knowledge of the neutron flux spectra throughout the reactor. The differential neutron spectrometry techniques being too scarce and too limitative, as well in the neutron energy interval covered as in their applicability, only a simultaneous analysis of them with computations and dosimetry methods in ad hoc facilities can lead to the required neutron dosimetry accuracies. A survey and status of the differential neutron spectrometry techniques presently applied or applicable is given. The complementarity with the other methods available and the limitations in their use to reach the neutron dosimetry goal are put forward.

8143 (NUREG/CP—0004(Vol.3)) **Dosimetry methods for fuels, cladding, and structural materials.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). 1977. 490p. (CONF-771036—P3). Dep. NTIS, PC A21/MF A01.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

Each paper has been separately abstracted and indexed for the Energy Data Base.

8144 (RE-P—78-050) **Validation of the ENDRAFL processing code and the RAFL/4 Monte Carlo code using ENDF/B IV nuclear data.** Wheeler, F.J. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1978. Contract EY-76-C-07-1570. 61p. Dep. NTIS, MF A01.

Portions of document are illegible.

The validity of the RAFL/4 Monte Carlo code to accurately predict criticality and reaction-rate distributions for a wide range of neutron spectra has been demonstrated. The RAFL/4 code uses an ENDF/B-IV fast-neutron library automatically generated by the ENDRAFL code and a thermal library generated by the FLANGE-II and INCITE codes. The validation studies consisted of an analysis of several benchmark critical experiments selected to cover a wide range of representative neutron spectra and intercomparisons with other neutron transport codes. The specific version of the RAFL/4 code used for these studies is referred to as RAFT/401 (May 23, 1978).

8145 (UNI—857) **Revised version of NEWIGL.** Dodd, L.R. (United Nuclear Industries, Inc., Richland, WA (USA)). 1 Oct 1977. Contract EY-76-C-06-1857. 120p. Dep. NTIS, PC E03/MF E03.

NEWIGL solves the one-dimensional, two-energy group, time-dependent diffusion theory equations using zero, one, or six delayed neutron goups. Thermal feedback is introduced through the solution of simplified, non-boiling heat transfer equations. Geometrical representation can be slab, cylindrical, or spherical. Steady-state diffusion theory routines are included and can be used to perform criticality searches and to calculate initial direct and adjoint fluxes for a transient problem. Transients can be initiated from time-dependent changes in coolant flow rates, coolant inlet temperatures, or external source strengths, or by simulated control rod movement. Two independent rod models are available for simulating control rod motion either parallel or perpendicular to the direction of calculation. A trip instrumentation model is included which monitors reactor operating parameters and scrams a rod bank upon actuation of a trip.

8146 **Second-order generalized perturbation theory for source-driven systems.** Greenspan, E. (Nuclear Research Center—Negev, Beer-Sheva, Israel); Gilai, D.; Oblow, E.M. *Nucl. Sci. Eng.;* **68**: No. 1, 1-9(Oct 1978).

A second-order generalized perturbation theory (GPT) for the effect of multiple system variations on a general flux functional in source-driven systems is derived. The derivation is based on a functional Taylor series in which second-order derivatives are retained. The resulting formulation accounts for the nonlinear effect of a given variation accurate to third order in the flux and adjoint perturbations. It also accounts for the effect of interaction between any number of variations. The new formulation is compared with exact perturbation theory as well as with perturbation theory for altered systems. The usefulnes of the second-order GPT formulation is illustrated by applying it to optimization problems. Its applicability to areas of cross-section sensitivity analysis and system design and evaluation is also discussed.

8147 **Numerical solutions to critical problem of reflected cylindrical reactor.** Horie, J. (Kyoto Univ. (Japan). Faculty of Engineering). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 12, 847-858(Dec 1977).

The multi-region critical problem can be transformed into an eigenvalue problem in the classical sense by using the method of Kuscer and Corngold and of Wing. This transformation is applied to derive a variational formulation for a reflected reactor. An approximate critical value of the multiplying factor is determined by maximizing the Rayleigh quotient for radially and totally reflected cylindrical reactors. It is shown that this approximate critical value is an upper bound of the true critical value. From the facts that the operator is self-adjoint and the eigenfunction is positive, an expresion is derived for the upper and lower bounds of the true eigenvalue, by making use of the approximate distribution. The difference of the upper and lower bounds is an uncertainty of the presumption of the true critical value. It is found that we can compute the bounds to any required precision. The narrow bounds are calculated for two radially and one totally reflected cylindrical reactors.

8148 **Possibility of determining the experimental fuel element power by a semistatistical method.** Sapozhnikov, V.V.; Svetlakova, N.N.; Edchik, I.A. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 2, 5-9(1977). (In Russian).

Under the same conditions it is proposed to measure the power density of the critical assembly simulating a reactor by using a static method and also to measure the power of the experimental fuel element in it by an independent method, thus obtaining their relation and then multiplying it by the nominal reactor power to determine the required power density of the experimental fuel element. In this case a design of the experimental fuel element substantially differs from that of reactor fuel elements. The method is based on the determination of the absolute power of the assembly by means of measuring the relation of a dispersion to an average value and a number of additional measurements. The accuracy of the method is evaluated.

8149 **Burnup control problem considering fuel failure probability.** Koga, R. (Okayama Univ. (Japan)); Nishimura, M.; Hattori, Y. *Tech. Rep. Inst. At. Energy, Kyoto Univ.;* No. 171, 1-10(Dec 1976).

A small fuel failure probability is taken into account for a burnup control system of a power reactor. The extent of the failure is supposed such that the reactor can still be operated by restricting the power to a lower limit than that before the failure. The effect of the probabilistic failure is measured by the deterioration of expectation value of the total energy which can be extracted from the fuel charged at the beginning of the core life. The neutronics model employed is linear and does not contain feedback effects. An algebraic expression is afforded, however, by making use of the Green function and the Walsh function expansion for the space dependence. As an example of this application, a maximization problem is solved giving a burnup trajectory that gives an extremal expectation of the average burnup in the case that an initial state is put in the degenerate region where the optimum trajectory is not unique.

8150 **Method of detecting a failed fuel.** Utamura, M.; Uchida, S. (to Hitachi Ltd.). Japanese Patent 1977-106,096/A/. 3 Mar 1976. 7p. (In Japanese).

The object of the method is to improve accuracy of detection by extracting a part of coolant in a fuel assembly, by injecting the extracted coolant into the fuel assembly after heating, and by promoting discharge of nuclear fission products from the failed part of the fuel. A cap is covered on a channel box of a fuel assembly. A hot water-injecting tube, an air-feeding tube and a sampling tube are provided on the cap. After extraction of a part of coolant and removal of nuclear fission products, the part of coolant is heated and fed to the fuel assembly. If there is failure of a fuel rod, a great quantity of fission products are discharged into a hot fed water. After several minutes, the hot water of the upper fuel assembly is removed from the sampling tube and the radioactivity is detected.

8151 Device for constantly monitoring power distribution in an axial direction of a reactor. Shimazu, Y. (to Mitsubishi Atomic Power Industries, Inc.). Japanese Patent 1977-106,094/A/. 2 Mar 1976. 5p. (In Japanese).

The object of the device is to make it possible to constantly monitor power distribution in an axial direction of a reactor, by arranging neutron detectors at intervals in an axial direction of a reactor core of a device for monitoring the power distribution of the reactor. A reactor core is arranged in a core tank placed in a pressure vessel. The core tank has an upper reactor core plate and a lower reactor core plate. A baffle plate is provided between these plates. A reflector is placed between a reflector core tank and a baffle plate. A pressure pipe is inserted into the inside of the reflector in the reactor core tank. The neutron detectors are arranged in the pressure pipe over a entire length of the reactor core at a given intervals in the axial direction. Power from the neutron detectors is introduced to outside and is connected to a display device.

COMPONENTS AND ACCESSORIES

REFER ALSO TO CITATION(S) 7915, 8248, 8314, 8315, 8603

8152 Permanently magnetic flowmeter probe for liquid metals. Mueller, S.; Krebs, L.; Thun, G. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Reaktorbauelemente). pp 943-946 of Reaktortagung, Hannover. Sektion 6. Bau und Betrieb von Kernenergieanlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

8153 (NUREG/CP—0004(Vol.1), pp 61-67) **Radiation damage outside the reactor vessel.** Rossin, A.D. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The radiation environment for reactor components outside the pressure vessel is discussed and the evidence indicating no radiation damage to these components is reviewed.

8154 (NUREG/CP—0004(Vol.1), pp 285-297) **Neutron fluence determination and safety analysis aspects of large specimen steel irradiations.** Bartholome, G. (KWU, Erlangen, Ger.); Cerles, J.M.; Leitz, C.; Nagel, G.; Schneider, W.; Soulat, P. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Outgoing from the question: how to design reactor pressure vessels against brittle failure--the introduction shortly reviews older and newer techniques in steel testing: the transition temperature concept and the fracture mechanics concept. The required characteristic values and the specimens for testing use according to those techniques are reported. Subsequently steel irradiation projects in Europe (as carried out in France and Germany, F.R.) are described. Under the metrological methods there is especially stressed the practical realization of neutron fluence measurements and the neutron spectrum determination with theoretical and measuring (unfolding codes) methods. Measuring problems which appear in connection with those irradiation tests and methods applied to solve them are given. To come to a conclusion, at first the requirements for the steel safety analysis are summarized. Radiation exposure quantities are reported which are in use for safety limitation of the steels. An outlook will be given with some suggestions for re-evaluable results which might be needed in further deepened comparison studies.

8155 (NUREG/CP—0004(Vol.2), pp 575-582) **Photofission effects in reactor pressure vessel dosimetry.** Bowman, C.D.; Eisenhauer, C.M.; Gilliam, D.M. (National Bureau of Standards, Washington, DC). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Experiments and calculations both suggest that serious backgrounds from photofission are present when threshold fission foils are used as spectral indices for fast neutron intensity and spectrum measurements in pressure vessel dosimetry. The problem might be resolved by a measurement of the higher energy γ-ray spectrum and intensity by means of induced activity from (γ,n) reactions.

8156 (ORNL/TM—6191/V2) **Monitoring of prestressed concrete pressure vessels. II. performance of selected concrete embedment strain meters under normal and extreme environmental conditions.** Naus, D.J.; Hurtt, C.C. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 89p. Dep. NTIS, PC A05/MF A01.

Unique types of instrumentation are used in prestressed concrete pressure vessels (PCPVs) to measure strains, stresses, deflections, prestressing forces, moisture content, temperatures, and possibly cracking. Their primary purpose is to monitor these complex structures throughout their 20- to 30-year operating lifetime in order to provide continuing assurance of their reliability and safety. Numerous concrete embedment instrumentation systems are available commercially. Since this instrumentation is important in providing continuing assurance of satisfactory performance of PCPVs, the information provided must be reliable. Therefore, laboratory studies were conducted to evaluate the reliability of these commercially available instrumentation systems. This report, the second in a series related to instrumentation embedded in concrete, presents performance-reliability data for 13 types of selected concrete embedment strain meters which were subjected to a variety of loading environments, including unloaded, thermally loaded, simulated PCPV, and extreme environments. Although only a limited number of meters of each type were tested in any one test series, the composite results of the investigation indicate that the majority of these meters would not be able to provide reliable data throughout the 20- to 30-year anticipated operating life of a PCPV. Specific conclusions drawn from the study are: (1) Improved corrosion-resistant materials and sealing techniques should be developed for meters that are to be used in PCPV environments. (2) There is a need for the development of meters that are capable of surviving in concretes where temperatures in excess of 66°C are present for extended periods of time. (3) Research should be conducted on other measurement techniques, such as inductance, capacitance, and fluidics.

8157 Thermal-neutron steady-state spectra in pure and poisoned light water assemblies. Swaminathan, K.; Tewari, S.P.; Bansal, R.M. (Univ., Delhi). *Nucl. Sci. Eng.;* **68**: No. 1, 137-140(Oct 1978).

Thermal-neutron steady-state spectra, in the presence of a 1/E epithermal source of neutrons, calculated in pure and poisoned light water assemblies, using the recent neutron scattering kernel of water suggested by Bansal et al., are found to agree with the recent experimental results of Abbate et al. The effect of different source terms on the steady-state spectra has also been studied.

8158 Analysis of the time-variable operating stresses of reactor components. Pt. 2. Klaetschke, H.; Zaschel, J.M. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Darmstadt (Germany, F.R.). Lab. fuer Betriebsfestigkeit). *Maschinenschaden;* **51**: No. 1, 1-7(1978). (In German).

There are various counting methods for frequency analyses of measured stress-time functions. The differences between these methods, their capabilities and limitations are discussed by means of an example. - It is often attempted to transfer the stresses measured at a certain location of a construction to other locations. This, however, necessitates that the vibration behaviour of the respective construction is known, as well as its influence on the stresses under consideration. The information which can be obtained by means of the correlation analysis is discussed for pressure pulsations during blowdown tests.

8159 Design and construction of prestressed concrete reactor vessels. Slough; Cement and Concrete Association (1978). 79p.

The objective of the report is to provide those concerned with the specification design and construction of prestressed concrete reactor vessels with a resume of background material, a presentation of principles and guidance, and a source of reference material. Subject headings include: basic philosophy; loading; design analysis; assessing accept-ability; liners, penetrations, closure and thermal systems; materials and construction; quality assurance and quality control; vessel instrumentation; proof testing, and commission and operation. The bibliography contains over 350 references, of which about 25% pertain to the section of design analysis. It is considered that the report fills a gap between the rigid language of a specific code and the practical aspects of designing and constructing a prestressed concrete reactor vessel.

8160 Pipelines in power plants. Quality assurance starting with planning up to operation. Oude-Hengel, H.H. Koeln, Germany, F.R.; TUeV Rheinland G.m.b.H. (1978). 710p. (In German).

Since the end of the Sixties, steam-transporting pipelines are given great attention, as pipeline components often fail, partially even long before their designed operation time is over. Thus, experts must increasingly deal with questions of pipelines and their components. Design and calculation, production and operation of pipelines are included in the discussion. Within the frame of this discussion, planners, producers, operators, and technical surveillance personnel must be able to offer a homogenous 'plan for assuring the quality of

pipelines' in fossil and nuclear power plants. This book tries to make a contribution to this topic. 'Quality assuring' means efforts made for meeting the demands of quality (reliability). The book does not intend to complete with well-known manuals, as for as a complete covering of the topic is concerned. A substantial part of its sections serves to show how quality assurance of pipelines can be at least partially obtained by surveillance measures beginning with the planning, covering the production, and finally accompanying the operation. There is hardly need to mention that the sort of planning, production, and operation has an important influence on the quality. This is why another part of the sections contain process aspects from the view of the planners, producers, and operators.

8161 Reactor pressure vessel, especially prestressed concrete pressure vessel. Rissler, P.; Degro, H. (to to Siemens A.G.). German(FRG) Patent 1,965,682/C/. 10 Nov 1977. 4p. (In German).

The invention deals with an improvement of the closure support for a prestressed concrete pressure vessel. In order to avoid bending moments the upper section of the cylindrical part of the pressure vessel is designed as an isolated supporting ring separated from the rest of the cylindrical part by means of a slip joint. It is connected with the pressure vessel by means of axial tendons. In this way well-defined stress conditions are obtained in the closure region.

8162 Welded or pressed double-plate tapered slide valve for pipeline systems in nuclear power plants. Dumpelmann, W.; Dumpelmann, W. (to Westark G.m.b.H.). German(FRG) Patent 2,615,220/A/. 27 Oct 1977. 9p. (In German).

The slide valve described permits perfect washing and cleaning of the inside of the housing. The housing has no plane surfaces and can be used in all pressure regions; the arrangement of the welded seams permit X-ray testing. The design is described in detail.

8163 Investigation of measuring accuracy of plugging indicators. Yamamoto, H.; Murase, M.; Izumi, S. (Hitachi Ltd., Kawasaki, K. (Japan). Atomic Energy Research Lab.); Sagawa, N. *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 10, 689-694(Oct 1977).

In order to improve the measuring accuracy of plugging indicators, the effects of operating conditions such as the sodium flow rate and the cooling air flow rate on the measuring error are analyzed. By this investigation, the measuring error can be evaluated as a function of the Reynolds and Stanton numbers, and suitable conditions which minimize the measuring error are obtained.

8164 Adjustable sealing device for a measuring and control system of a nuclear reactor. (to Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). German(FRG) Patent 2,144,087/C/. 29 Sep 1977. 7p. (In German).

The sealing device for detection guide tubes saves considerable space to be used for other operational installations and simplifies and shortens withdrawal of these detectors during a refuelling period. A number of standpipes are vertically welded into the hemispherical bottom of the reactor pressure vessel and open out at the lower end of the core. After a 90 degree deflection with large radius below the reactor pressure vessel these pipes pass through the biological shield in horizontal direction and terminate in a measuring chamber aside of and below the reactor pressure vessel. Neutron detectors are inserted into the guide tubes by means of their special leads and positioned at the desired height; during reactor operation they signalize the instantaneous neutron flux to the measuring chamber or to any other place. The device according to the invention consists of a refined gland desing. In the measuring position, i.e. during reactor operation, both 'glands' are tightened and resist the coolant pressure of about 150 bar. After shutdown of the reactor for refuelling one of the glands is loosened and permits withdrawal of the guide tubes together with the detectors. The other gland still seals against a coolant pressure of about 3 bar. Withdrawal of the tubes with the detectors protects those against damaging at refuelling.

8165 Reactor pressure vessel. Dorner, H.; Scholz, M.; Jungmann, A. (to to Siemens A.G.). German(FRG) Patent 2,238,886/B/. 8 Sep 1977. 3p. (In German).

This supplement to P2164128 describes a design supplement to a detail of the main patent, achieving a higher safety level of the pressure vessel. According to the supplementary application this is achieved by exact dimensioning of a cold clearance with the aim of well-defined prestressing and therewith traction resp. pressure relief in the 300°C hot state. The main patent protects a steel pressure vessel whose bolted closure head is secured against lifting or ejection by a superposed catching ring. The catching ring is self-lockingly arrested by a number of catch hooks swing over it. After hydraulically seinging out the catch hooks, the vessel head together with the catching ring can be lifted without difficulty. The catch hooks are individually supported by a steel structure enclosing the vessel head and being tied to the vertical steel reinforcement or the upper edge of the enclosing concrete vessel. The cold clearance between catching ring and overlapping hooks according to the additional application is smaller than the heat expansion at operational temperature. By this and by means of appropriately calibrated intermediate steel layers a well-defined prestressing of the vessel head during operation is additionally applied, thus relieving the whole vessel.

8166 Combination of outlet nozzle and inlet pipe for a nuclear reactor pressure vessel. McDonald, B.N. (to Babcock and Wilcox Co.). German(FRG) Patent 2,618,345/B/. 8 Sep 1977. 5p. (In German).

This combination of water inlet and steam outlet of a heat exchanger built into a reactor pressure vessel and the close connection between heat exchanger and pressure vessel halves the number of penetration of demanding design and reduces the temperature problems. A vertical vessel wall contains a larger penetration. An exterior steam outlet nozzle is centered and bolted on a seat screwed on concentrically from outside. On an inner ring-shaped area with another diameter the outlet nozzle of the steam generator is amounted coaxially, projects into the wall penetration and, together with the other nozzle, forms the first part of a main-steam pipe. An inlet pipe for feedwater enters the main nozzle from below by means of a side nozzle. This pipe, deflected by 90 degrees, horizontally passes the wall of the vessel in opposite direction to the steam flow and discharges the water through a spray head into a larger vertical downcomer.

8167 Stress intensity factor for a semi-elliptical crack in an internally pressurized cylinder. Nishimura, A. (Hitachi Ltd., Tokyo (Japan)); Aoki, S.; Sakata, M. *Nippon Kikai Gakkai Rombunshu;* **43**: No. 373, 3192-3199(Sep 1977). (In Japanese).

Recently, the fatigue strength of the thick-walled cylinders subjected to repeated internal pressure is regarded as important concerning the design of chemical plants, the pressure vessels for nuclear reactors, pipings and others. In the fatigue due to repeated internal pressure of thick-walled cylinders, it was observed that cracks occur on the internal surfaces and develop semi-elliptically. Therefore at the time of studying the development behavior of cracks from the standpoint of the fracture mechanics, it is necessary to know the stress intensity factor. Sufficient analysis has not been made yet in case of the semi-elliptical cracks present on the internal surfaces of internally pressurized cylinders because the form is complex and the stress is not uniform. In this study, the stress intensity factor of semi-elliptical surface cracks present on the internal surfaces of infinite thick-walled cylinders was determined by the volume force method developed by Nishitani, and using this result, the approximate value of the stress intensity factor of semi-elliptical surface cracks present on the internal surfaces of finite thick-walled cylinders was determined. The method of the calculation by the volume force method, the result of the calculation, and the extension of the result to finite thick-walled cylinders are explained.

8168 Finite element analysis of pipe bend with straight pipes. Kano, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Takeda, H.; Asakura, J. *Atsuryoku Gijutsu;* **15**: No. 4, 209-222(Jul 1977). (In Japanese).

When bent pipes are subjected to bending moment, the pipe ends turn easily as the cross section is somewhat flattened, and the deflection is several times as much as that calculated as ordinary curved beams. Therefore, bent pipes are the very convenient structural elements for absorbing the thermal expansion of piping systems. The important loads applied to bent pipes are internal pressure and bending moment, and recently, the studies on the stress and deformation of bent pipes are concentrated on inelastic analysis rather than elastic analysis. The results of analyses made so far involve various assumptions, and many subjects to be analyzed hereafter remain in the actual stress distribution and deformation of bent pipes. In this paper, for the purpose of grasping exactly the stress distribution of the bent pipes with straight parts, the results of analysis by the finite element method are reported. In order to compare the characteristics of elements, three-dimensional continuum element, plate shell element and elbow element were used for the same problem. In this analysis, special attention was paid to the end effect of bent pipes. The finite element models and the results of analysis are described. The analysis with plate shell element is most suitable in view of the accuracy and calculation cost.

8169 Valves for condenser-cooling-water circulating piping in thermal power station and nuclear power station. Kondo, S. (Nippon Valve Mfg. Co. Ltd., Tokyo). *Karyoku Genshiryoku Hatsuden;* **28**: No. 7, 663-672(Jul 1977). (In Japanese).

Sea water is mostly used as condenser cooling water in thermal and nuclear power stations in Japan. The quantity of cooling water is 6 to 7 t/sec per 100,000 kW output in nuclear power stations, and 3 to 4 t/sec in thermal power stations. The pipe diameter is 900 to 2,700 mm for the power output of 75,000 to 1,100,000 kW. The valves used are mostly butterfly valves, and the reliability, economy and maintainability must be examined sufficiently because of their important role. The construction, number and arrangement of the valves around a condenser are different accord-

ing to the types of a turbine and the condenser and reverse flow washing method. Three types are illustrated. The valves for sea water are subjected to the electrochemical corrosion due to sea water, the local corrosion due to stagnant water, the fouling by marine organisms, the cavitation due to valve operation, and the erosion by earth and sand. The fundamental construction, use and features of butterfly valves are described. The cases of the failure and repair of the valves after their delivery are shown, and they are the corrosion of valve bodies and valve seats, and the separation of coating and lining. The newly developed butterfly valve with overall water-tight rubber lining is introduced.

8170 Dynamical stability of a two-phase chemically reacting flow. 1. Mathematical model. Andrizhievskii, A.A.; Mikhalevich, A.A.; Nemtsev, V.A. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 4, 58-65(1977). (In Russian).

A mathematical model of dynamics of a two-phase flow of dissociating nitrogen tetroxide in a steam generating channel has been given. A physical process is described by a set of one-dimensional nonstationary differential equations for a flow, to which a nonstationary heat conductivity equation for the material of channel walls and closing algebraic relations are added. Separate parameters of one-dimensional flow have been obtained by means of averaging local characteristics of a two-phase system over the heat exchange surface.

8171 Experimental study on heat transfer with condensation of vapors of pure nitrogen tetroxide with nitrogen oxide additions on a bundle of horizontal tubes. Batishcheva, T.M.; Derov, B.T.; Kolykhan, L.I.; Pulyaev, V.F. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 4, 66-72(1977). (In Russian).

The results of an experimental investigation of heat transfer during condensation of pure N_2O_4 vapours and with NO admixtures on the outside surface of a bundle of horizontal tubes are considered. The tests with pure N_2O_4 have been performed at pressures between 0.3-1.0 MPa in the range of thermal loads 22-121 kW/m^2, temperature heads of 5-33 grades with complete condensation and evaporation. The content of admixtures boiling at high temperatures do not exceed 0.8%. A concentration of noncondensing nitrogen oxide in a gas phase have changed in the range of 3-27%. It is shown, that a concentration of noncondensible NO doesn't result in a considerable decrease of the heat transfer intensity as well as in the case of condensation of vapour-liquid mixtures. The generalized criterion relations are presented.

8172 Heat exchange with cooling by chemically reacting N_2O_4 in high-temperature heat exchangers. Devoyno, A.N.; Nemtsev, V.A.; Stepanenko, V.N. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 3, 57-60(1977). (In Russian).

A comparison between various methods of calculation of heat transfer with cooling by the chemically reacting system N_2O_4 reversible $2NO_2$ reversible $2NO + O_2$ and the experimental data obtained has been made. It has been shown that when determining heat exchange of gaseous N_2O_4 at high pressures and temperatures of the wall, it is necessary to take into account the effect of concentration gradients of the NO and O_2 components along the channel radius; otherwise it can result in a substantial error in the calculation of a high-temperature heat exchanger with the N_2O_4 coolant. It has been found out that at moderate pressures and wall temperatures corresponding to the reaction region N_2O_4 reversible $2NO_2$ the concentration gradients NO and O_2 along the channel radius can be neglected.

8173 Effect of deviations of different parameters on variation of characteristics of a regenerator-evaporator of a power plant with a dissociating coolant. Greben'kov, Zh.A.; Zatsepin, O.I. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 4, 13-18(1977). (In Russian).

An effect of various deviations on characteristics of a regenerator-evaporator of a power plant operating in the circuit with a gas-liquid N_2O_4 cycle has been studied. An investigation of the effect of deviations of parameters on variation of thermal and hydraulic characteristics of a direct-flow regenerator-evaporator has been performed by the small deviation method. Using this method, a calculation procedure has been developed, based on the linearization of a set of equations, describing thermal and hydraulic processes in a regenerator-evaporator with partial loadings. Relative changes of the outlet temperatures and pressures, as well as the regenerator-evaporator performance at this or the other disturbanoe of the initial state have been given. By means of the table of influence coefficients it is possible to predict the reasons for failures of a regenerator-evaporator or non-conformity of calculated and actual performances.

8174 Autoclave simulations studies of condenser in leakage in nuclear steam generators. Wootten, M.J.; Economy, G.; Bulischeck, T.S. (Westinghouse Research Labs., Pittsburgh). pp 51-60 of International water conference. Pittsburgh; Engineers's Society of Western Pennsylvania (1977).

From 37. international water conference; Pittsburgh, PA, USA (26 Oct 1976).

In the operation of nuclear steam generators, the consequences of contamination of the secondary side water by in—leaking cooling water have been the subject of considerable concern. Theoretical considerations show that sea water, brackish water, and some types of fresh water are acid forming waters whereas other types of fresh waters are possibly able to form free alkalinity when leaked into a steam generator. An apparatus is described that enables one to investigate the effect of cooling water composition, condenser in-leakage rates, and blowdown rates on the solution chemistry in nuclear steam generators. Contaminants are injected at a known dilution into condensate that is recirculated to an autoclave boiler. Concentration of non-volatile species within the autoclave and changes in bulk water chemistry are monitored by analysis of the blowdown. Preliminary results with sea water in-leakage are discussed.

8175 Reactor fuel replacement system. Kayano, H.; Joge, T. (to Hitachi Ltd.). Japanese Patent 1977-137,590/A/. 12 May 1976. 6p. (In Japanese).

The object of the invention is to reduce exposure of radiation and increase the efficiency of a fuel rod replacement operation by dividing the fuel storage pool into a plurality of regions depending upon the position of a fuel rack, determining a fixed point in each of the regions and moving the fuel rod through a straight route up to a fixed point. A fuel storage pool is divided into a plurality of regions depending upon the position of a fuel rack, a fixed position is determined for each of these regions, and the above items are memorized by an electronic computer such that the fuel rod can be moved through a straight route to each of the fixed points. Thus, when the fuel replacement unit is moved from the fuel storage pool through a gate, it is moved to a fixed point by simultaneously moving its two axes, namely x- and y-axes, such that it is moved along a straight route of the smallest distance from a region, to which a fuel rack of a fuel rod to be moved belongs, to a fixed point preset in the neighborhood of the entrance of a gate corresponding to the relevant region. Thereafter, the fuel replacement is moved from a stationary point to the core pool, to thereby effect replacement of the fuel rod.

8176 Fuel replacement system of a reactor. Kayano, H.; Joge, T.; Nakagima, M. (to Hitachi Ltd.). Japanese Patent 1977-135,992/A/. 10 May 1976. 7p. (In Japanese).

The object of the invention is to provide the above-identified system, with which the operation of fuel replacement is automatically carried out by an electronic computer for control, and which ensures safe and logical operation by effecting decision as to permission or non-permission of operation before the start thereof. A running base is provided with a first motor, and a transverse running base is provided with gripping means, a grapple and a hoist and is adapted to be moved by a second motor along a pair of rails provided on the running base. The grapple is made vertically movable by the hoist and a third motor, and is made rotatable by a fourth motor for adjusting the fuel angle. The first to fourth drive motors are operated by an operating signal, which is based upon a command from an operator console and is coupled to these motors through a central processing means adapted to determine permission or non-permission of operation, a process input-output means and a control panel.

8177 Method and apparatus for removing an in-core monitor. Yoshida, T.; Saito, T.; Ishii, Y.; Arikawa, I.; Yamagata, H. (to Hitachi Ltd.). Japanese Patent 1977-127,593/A/. 16 Apr 1976. 5p. (In Japanese).

The object of the invention is to put an unremovable in-core monitor in a suitable position by remote control within a reactor and thereafter to remove the in-core monitor. A cutter body comprises an upper gripping mechanism, a mechanism for upwardly and downwardly moving the upper gripping mechanism, a cutter portion, and a lower gripping mechanism, and when the in-core monitor becomes impossible to be removed from a core, the cutter body is set within a cell of a top guide. First, the in-core monitor can be gripped by the gripping mechanism and then cut by operation of the cutter portion. Next, the lower part of the monitor is gripped by the lower gripping mechanism. Whereafter, the upwardly and downwardly moving mechanism can be operated to remove the head of the in-core monitor from a recess in a top guide. When the cutter body is then removed from the top guide, the in-core monitor is completed to be cut and removed.

8178 Reactor container. Ichiki, T.; Nagatomi, S. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-114,887/A/. 24 Mar 1976. 4p. (In Japanese).

The objects of the invention is to provide a jet and missile protective wall of a configuration being inflated toward the center of a reactor container on the inside of a body of the reactor container disposed within a biological shield wall to thereby increase safety of the reactor container. A jet and missile protective wall comprised of curved surfaces internally formed with a plurality of arch inflations filled with concrete between inner and outer iron plates and shape steel beam is provided between a reactor container surrounded by a biological shield wall and a thermal shield wall surrounding the reactor pressure vessel, and an adiabatic heat insulating material is filled in space therebetween.

8179 Detection apparatus for a failed fuel. Oda, M.; Wada, M. (to Mitsubishi Electric Corp.). Japanese Patent 1977-113,490/A/. 18 Mar 1976. 5p. (In Japanese).

The object of the invention is to provide a detection apparatus for failed fuel for measuring a gamma radioactivity of primary coolant or primary cover gas in a reactor, comprising a device having a particularly improved means for the process of detection signal. This detection apparatus for failed fuel comprises a scintillation detector, a single channel pulse height analyzer, and a differential circuit, whereby measuring changes in time of radioactivity of specific nuclide. With this arrangement, only the nuclide of short half-life may be measured to thereby reduce a response time and measure changes in time of radioactivity, thus avoiding effect of background. Further, function of the differential circuit and action of sampling delay time produce a selectivity to reinforce a function for discriminating the nuclide.

8180 Thermal insulation structure for a reactor pressure vessel. Suzuki, M. (to Hitachi Ltd.,). Japanese Patent 1977-110,391/A/. 12 Mar 1976. 3p. (In Japanese).

The object of the invention is to provide an easy handling structure of a thermal insulation in order to minimize a radiation exposure dose of an operator in a reactor pressure vessel. In order to minimize a radiation exposure dose of an operator in mounting and dismounting operation, a rotary shaft of a shielding plug for a biological shield is connected to a rotary shaft of a thermal insulation material for a nozzle by positive motion means, so that the thermal insulation material is opened and closed together with open and close of the plug simultaneously. Whereby, when inspection during common service, operation of the thermal insulation material at a distance apart from the reactor pressure vessel is effected efficiently for a short time.

8181 Reactor core. Otsuji, N. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-109,095/A/. 9 Mar 1976. 4p. (In Japanese).

The object of the invention is not only to secure a stable power control by feeding an adequate coolant flow to a reactor core, but also to prevent a fuel failure by improving thermal conditions. Both ends of a fuel bundle housed in a fuel channel are fixed with each upper and lower portion of a tie plate. The lower tie plate distributes a coolant between fuel rods, and the upper plate is fitted with a low control plate and a connection spacer. This space is provided with a large through-hole at a center and the coolant flow is controlled by regulating a diameter of the spacer with an orifice.

8182 Reactor. Shirakawa, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1977-104,683/A/. 28 Feb 1976. 3p. (In Japanese).

The object of the invention is to extend average life of neutrons formed during the course of nuclear fission, to suppress an increase in density of neutron, thus enhancing the reactor stability. Within a reactor vessel, a number of reactor fuels are received in line, a coolant being passed between the fuels, and a reflection member is disposed in the periphery of the fuels. A beryllium curtain is suspended in a clearance between the fuels. With this arrangement, at the time of nuclear fission, prompt gamma rays and delayed gamma rays appear by the mechanism similar to the delayed neutron. However, the beryllium has a property which adsorbs the gamma and belches the neutron, and the neutron emitted in reaction with the delayed gamma rays has the effect as the delayed neutron in terms of a wide sense. Therefore, even if a sudden halt of a turbine should occur, it is possible to suppress a rapid neutron increase.

8183 Method of obtaining the rate of leakage in a reactor container. Sanada, T.; Takashima, Y. (to Hitachi Ltd.). Japanese Patent 1977-104,689/A/. 27 Feb 1976. 4p. (In Japanese).

The object of the invention is to measure a flow rate, pressure, temperature and the like of gases fed to a reactor container and use values obtained therefrom to obtain the rate of leakage in a reactor container during the normal operation of the reactor. A reactor is received in to a reactor container and comprises an exhaust disposing system, a gas feeding system and the like. A pressure detector and a temperature detector are provided to measure the quantity of gases within the container, and a flow detector, a pressure detector, and a temperature detector are provided to accurately measure the weight of gases flown into the container. Further, an atmospheric pressure detector is provided to count the rate of allowable leakage, and the measured values are processed by a computer to obtain the rate of leakage. In addition, an alarm display plate is provided to provide an alarm when a level exceeds the rate of allowable leakage.

8184 Process for removing radioactive nuclides in reactor cooling water, using oxine and activated carbon. Motojima, K.; Imahashi, T.; Yamaguchi, K. (to Japan Atomic Energy Research Inst.). Japanese Patent 1977-104,695/A/. 21 Feb 1976. 3p. (In Japanese).

The object of the process is to efficiently remove any induced radioactive nuclides produced in a coolant of light-water type power reactor, nuclides forming a hardly soluble complex with oxine, and iodine. Structure: Oxine (8-hydroxyquinoline) is added to a cooling water and leaked water form a reactor. Whereby, oxine compounds and oxine complexes of radioactive nuclides which are stable and difficult to dissolve into water, is formed. When an activated carbon is added thereto, the oxine compounds and the like are adsorbed on the activated carbon very efficiently.

8185 Technique for regeneration of cold traps for impurities of alkali metal coolant. Volchkov, L.G.; Kozlov, F.A.; Tonov, B.I.; Nalimov, Yu.P.; Likharev, V.A. USSR Patent 473,221/A/. 5 Jun 1975. Filed date 25 Jun 1973. 2p. (In Russian).

A method has been developed for the regeneration of cold traps of alkali metal coolants. The method consists in heating the trap and removing liquefied admixtures. To reduce a regeneration period the trap is heated up to 500-550 deg C after the coolant has been removed. This temperature is maintained throughout the reaction between the admixtures resulting in formation of alkali metal hydroxide with availability of hydrogen released in the process of hydride decomposition in the trap volume. To ensure regeneration of the traps which have accumulated excessive metal oxide a melt of metal hydroxide or some other substance capable of hydrating oxide, e.g., hydrogen, is introduced into the trap volume.

FUEL ELEMENTS

REFER ALSO TO CITATION(S) 8137, 8141

8186 (CONF-781105—29) **Technique for estimating relocated gap width for gap conductance calculations.** Klink, P.H. (Idaho National Engineering Lab., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 6p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Thermally induced fuel fragmentation and relocation has been demonstrated to influence the thermal behavior of a fuel rod in two ways. The effective fuel pellet conductivity is decreased and pellet-to-cladding heat transfer is improved. This paper presents a correlation between as-built and relocated gap width which, used with the Ross and Stoute Gap Conductance Correlation and an appropriate fuel thermal expansion model, closely predicts the measured gap conductances.

8187 (NUREG/CP—0004(Vol.1), pp 401-410) **Post-irradiation dosimetry measurements on nuclear fuel.** Fudge, A.J.; Foster, E.; Banham, M.F. (Atomic Energy Research Establishment, Harwell, Eng.). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

These requirements of dosimetry are being met by measurement of fission flux and fluence for all of the fissioning species present or produced in nuclear fuel. Measurements of fission fluence or burn-up are made chiefly by post irradiation destructive analysis of the fuel for changes in the heavy element nuclide inventory and for stable and radioactive fission product nuclide abundances. Burn-up distribution in fuel on a longitudinal and radial basis is best obtained by gamma-ray scanning. Fission flux or rating can be evaluated from fluence measurements and power/time records. The precisions and accuracies required and obtained for the applications of nuclear fuel dosimetry are considered together with developments and additional requirements of nuclear data. Experience of many years of fuel dosimetry measurements for a wide range of fuel and reactor types is also presented.

8188 (NUREG/CP—0004(Vol.1), pp 423-431) **Activity of the Joint Research Centre Ispra in the field of post irradiation analysis of spent fuel.** Guardini, S.; Guzzi, G. (Commission of the European Communities, Ispra, Italy). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The activity of the Joint Research Center, Ispra, in the domain of post irradiation analysis of spent fuel is presented. Burn-up, isotopic compositions and build-up of heavy elements are derived from measured analytical data, with the aim of preparing a set of "clean data" to be used for checking the accuracy of nuclear codes.

8189 (NUREG/CP—0004(Vol.1), pp 433-447) **Special methods of non-destructive burn-up determination for nuclear fuels.** Ramthun, H. (Physikalisch-Technische Bundesanstalt, Brunswick). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The importance of the burn-up determination for efficient reactor operation and for the safeguards is discussed. After giving a short review of such procedures which yield the burn-up value without destroying the fuel rod, a more detailed description is given of how the burn-up value--averaged over the fuel rod--is calculated from the heat power measured in a suitable calorimeter. Examples are given of measurements carried out on highly or less enriched nuclear fuels, and the results are compared with those obtained by means of other procedures (also destructive ones, such as the mass spectroscopic determination of the fractions of heavy nuclei in the fuel before and after irradiation). It turns out that this thermal method is easily applied and that it yields well reproducible values with uncertainties often smaller than those for the whole rod, for example from the gamma ray spectroscopy of fission products. The main reason for this is the direct integral measurement of the characteristic quantity. For the spectroscopy of fission products, the subsequent evaluation yields primarily a burn-up value which is only valid for the small area of the fuel rod viewed by the collimator. Covering the whole rod in this way is time consuming and involves additional uncertainties. A description is given of the design, the mode of operation and the characteristic data of a prototype calorimeter developed for MTR fuel rods.

8190 (NUREG/CP—0004(Vol.1), pp 449-467) **Applications of reactor gamma scanning to fuel irradiation.** Simonet, G. (CEA, Gif-sur-Yvette, France); Cerles, J.M.; Perves, J.P.; Michel, F. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Gamma scanning enables direct, rapid, non destructive experiment analysis about nuclear fuel. French experimental reactors are provided with gamma spectrometry facilities of which various designs are described. Evolution of a large number of fission products can be followed in space and over time, along the fuel life. This gives an understanding in temperatures, changes in structure and behavior of the fuel and its cladding. Quantitative dosimetry provides information operating power and burn-up. Such considerations prove well adapted to present requirements as concern reactor safety and fuel management.

8191 (NUREG/CP—0004(Vol.1), pp 469-475) **Review of fuel burnup techniques in U.S.** Bishop, W.N. (Babcock and Wilcox, Lynchburg, VA). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Measurement of fuel burnup and the development of methods for measurement of fuel burnup are performed at numerous industrial and government laboratories. Most of the burnup measurements are associated with fuel development and testing for fast, light water and gas cooled reactors. Development and evaluation of burnup methods are primarily centered in government laboratories. The development work is directed at fast reactor applications, but most of the methods being tested are likely to be useful for light water reactors also. Determination of fission yields from various actinide nuclides continues to be a major activity. Most burnup measurements use a combined heavy element-neodymium-148 method. High resolution gamma spectroscopy is used frequently, both for non-destructive scanning and destructive burnup analysis. Several spectrophotometric methods have been used. The most successful spectrophotometric determination is zirconium for gas cooled reactor fuel. Development work includes better separation techniques and evaluation of new monitors.

8192 (NUREG/CP—0004(Vol.1), pp 477-498) **Specific burn-up determination and qualification of fuel irradiation dosimetry calculations based on post-irradiation measurements.** Robin, M. (CEN, Cadarache, France). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Essential parameters in fuel irradiation analysis are the specific burn-up factor and related fuel composition variations: these data are required to optimize the power reactor fuel cycle (production, irradiation, discharging, reprocessing). Metallurgical examination findings in research reactor must be correlated with data characterizing neutron irradiation of fuel and structural materials. A multitude of widely differing techniques have been developed for irradiated fuel research. These are assessed according to a number of interrelated criteria: precision, ease and cost of application, dismantling and destruction of fuel, absolute or comparative results, etc. On analysis, these methods prove complementary rather than competitive.

8193 **Improved finite difference method to evaluate heat transfer in fuel pins with eccentrically placed pellets.** McNair, G.W.; Peddicord, K.L. (Oregon State Univ., Corvallis). *Nucl. Technol.;* **40**: No. 3, 306-314(Oct 1978).

A method is presented to calculate two-dimensional temperature profiles in fuel pins with eccentrically placed fuel pellets. This is implemented in a finite difference program. By requiring continuity of the radial and angular components of the heat flux vector across the gas gap, an angular-dependent thermal conductivity is derived to account for the eccentric condition. The method is compared with another approach in which the fuel pellet surface is approximated by a "ratchet" boundary. Similar results for temperatures were obtained from both calculations, but the "modeled conductivity" method presented here showed significant gains in computing time and storage requirements.

8194 **Criticism on fuel rod structural analysis.** Lassmann, K. (Technical Univ., Darmstadt). *Nucl. Technol.;* **40**: No. 3, 321-328(Oct 1978).

The state-of-the-art in fuel rod structural analysis is discussed, and possible future developments in this field are outlined. The conclusion is drawn that the most important goal for future research is a deeper understanding of material behavior. It is suggested that a strategy of successive use of diverse models appropriate to the varying degrees of theoretical sophistication be followed in fuel rod structural analysis: preliminary work should be an analysis of the integral fuel rod with one-dimensional models, followed by local two-dimensional analyses. Finally, the deterministic analyses should be augmented by probabilistic work. All these modeling approaches are inevitably complementary in exhaustive fuel rod analysis, but they are, despite the tremendous theoretical efforts, no substitute for fuel rod performance tests. Nevertheless, analytical modeling will remain an indispensable tool for a long time to come, since with this theoretical background, the interpretation of experimental results is facilitated, and a better insight into fuel rod behavior is provided.

8195 **Fuel rod for nuclear reactor.** Hannerz, K.; Junkrans, S.; Vesterlund, G. (to ASEA-ATOM AB). Swedish Patent 7,501,251-8/B/. Apr 1978. 3p. (In Swedish).

A fuel rod is described in which the fuel pellets lie in a can made of zirconium alloy. The inner wall is coated with a copper or nickel net. The friction between pellet and can is reduced by the net. Consequently a deformation of the pellets, taking place at a fast increase of the effect, will not cause cracks of the can. Also a chemical reaction takes place between the iodine produced by fission and the copper. Thus the reaction $Zr+I \rightarrow ZrI_2$ will be less important.

8196 **New 420 kV circuit-breaker with only two interrupters per pole.** Junken, W. (Siemens, Erlangen, Ger). *Siemens-Z.;* **52**: No. 4, 191-192(Apr 1978). (In German).

The range of Siemens BK (puffer) breakers has been extended by a model with only two interrupters per pole, designed for rated voltages of 362 and 420 kV and short-circuit breaking currents of up to 40 kA. The fact that its number of component parts has been reduced considerably makes the new breaker even more reliable and reduces installation and maintenance costs. The simplified design was made possible by utilizing the SF_6 in the double nozzle arrangement to optimum effect.

8197 **Drying of encapsulated parts (nuclear fuel rods) in applying vacuum, by introducing dehydratings, vacuum, and filling with an inert gas.** Johnson, C.R. (to Babcock and Wilcox Co.). French Patent 2,311,262/A/. 5 May 1976. 8p. (In French).

This invention concerns a decontamination technique, in particular a process and equipment for extracting the water contained in fuel rods and other similar components of a nuclear reactor. The extraction of the contaminants contained in the fuel rods is carried out by a standard method by drilling a small hole in the surface of the cladding and applying a vacuum to bleed the rod of its impurities (moisture and gas). The invention consists for example in applying a

vacuum at the hole drilled in the cladding to extract the contaminants and introducing spirit into the rod through the same orifice. The spirit absorbs the remaining liquid and other impurities. The spirit charged with the impurities is then pumped out by the same aperture by means of a regulated atmosphere inside a closed receptacle. This receptacle is then filled with an inert gas cooled to ambient temperature. The rods are then pressurised and the small orifice is sealed .

8198 Method of manufacturing nuclear fuel rods. Sato, M.; Oyama, M.; Yamamoto, T. (to Hitachi Ltd.). Japanese Patent 1977-113,495/A/. 19 Mar 1976. 4p. (In Japanese).

The object of the process is to inspect for the presence of light white deposits on a clad tube during the process of manufacturing nuclear fuel rods and then remove this to reproduce a good clad tube, thereby enhancing a yield of the clad tube. When a light white deposit is found to appear on outer or inner surface of coating during the process of appearance inspection, this is then subjected to hot water immersion and discrimination. Requirements for removal of adhered matter in the process of treatment of hot water immersion are that deionized water of specific resistance 5 x 10^5 ohms or more is used with water temperature maintained at 60 to 100°C for immersion treatment for 10 to 30 minutes. In this case, however, if the water temperature is more than 80°C, the immersion time can be set less than 10 minutes. With the addition of such process described above, about 2.5% of total receiving number can be reproduced.

8199 Nuclear fuel element. Yasuda, T.; Ito, K.; Shimpo, K.; Takagi, H. (to Hitachi Ltd.). Japanese Patent 1977-113,494/A/. 19 Mar 1976. 5p. (In Japanese).

The object of the invention is to provide an arrangement wherein when a fuel pellet within a clad tube is applied with a stress or strain, such can be allowed and failure due to deformation can be prevented. In a structure wherein a cylindrical fuel pellet including oxide of nuclear fuel material is charged into a sealed clad tube, hardness in an outer peripheral portion of the fuel pellet is made lower than hardness in the center thereof and oxygen concentration in an outer peripheral portion of the fuel pellet is made higher than that of the center thereof. A region, of which rate of bond between the oxygen and the nuclear fuel material is more than 2.05, is present over 15% from the outer periphery of pellet radius.

8200 Process of making fuel elements. Ozawa, T. (to Tokyo Shibaura Electric Co. Ltd.,). Japanese Patent 1977-101,397/A/. 20 Feb 1976. 5p. (In Japanese).

The object of the process is to shorten drying time of fuel pellets and to prevent creation of oxidation of the pellets and change in O/U ratio. Structure: UO_2 powder is crushed into those having a desired grain size, and thereafter, the powder is molded under pressure into a cylindrical shape to form green pellets. This pellet is sintered in a sintering furnace while reducing in the presence of hydrogen flow. The sintered pellet is subjected in its outer surface to grinding to finish it into a desired dimension, which is then inserted into a Teflon board and inserted into a micro-dryer. This micro-dryer comprises a chain conveyor, a microwave oscillator device, and a microwave leakage prevention device. The pellet is irradiated by the microwave to heat moisture and water in the pellet until they are vaporized, thus drying the pellet.

CONTROL SYSTEMS

REFER ALSO TO CITATION(S) 8312

8201 (BMFT-FB-K—77-07) Neutron physical investigations on the use of burnable poisons and gray absorber rods in large pressurized water reactors. Brosche, C.; Katinger, T.; Kollmar, W.; Thieme, K.; Wagner, M.R. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1977. 37p. (In German). Dep. NTIS (US Sales Only), PC A03/MF A01.

Methods and results of neutron physics calculations are described using burnable poisons and gray absorber rods in large PWR's. Calculated and measured values are compared, the effort for programming has been guessed.

8202 Dynamic measurements of a nuclear reactor using low-peak-factor excitation signals. Flower, J.O. (Univ. of Sussex, Brighton, Eng.); Forge, S.C.; Radcliffe, N.G.; Roust, C.B. *Nucl. Sci. Eng.;* **68**: No. 1, 110-115(Oct 1978).

Presented is an application of Schroeder-phased harmonic signals, which have low peak factors, to the measurement of the dynamics of a nuclear reactor, i.e., the frequency response. The theory of such signals is given, and their properties relevant to such an application are discussed. The results of experimental measurements taken on a zero-energy research reactor are presented.

8203 Control of nuclear power plants. Frogner, B.; Rao, H.S. (Syst Control Inc, Palo Alto, Calif). *IEEE Trans. Autom. Control;* **AC-23**: No. 3, 405-417(Jun 1978).

The control of nuclear power plants covers a wide range of problems and requires understanding of the many interactions and objectives involved in obtaining operational flexibility and safety. Improved solutions must be developed as nuclear plants will increasingly require operation in a load-following mode. The authors discuss applications, problems, trends, and their perspectives. Areas where researchers developing control methods can contribute toward improved control design are outlined. 72 refs.

8204 Guidance systems in nuclear power plants. Jaschek, H. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Fachrichtung Elektrotechnik). *Waerme;* **84**: No. 1, 42-46(Mar 1978). (In German).

Using the example of a 1200 MW PWR nuclear power plant, the control systems of this plant are explained, e. g. measuring, open-loop control, feedback control, limiting, and protection systems. Finally some development trends in control are pointed out.

8205 Decoupling control of nonlinear coupled core reactor. Tsuji, M.; Ogawa, Y. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 12, 859-868(Dec 1977).

This paper concerns the application of the decoupling theory for a nonlinear system to the power control of the coupled core reactor. By using this theory, one can deal with the power change problem, the regulating problem for a system subject to a large perturbation, etc., which cannot be dealt with by the decoupling theory for a linear system. But, since this theory assumes tacitly that all the states are measurable, the theory can not be applied directly to the nuclear reactor that has nonmeasurable state variables such as the delayed neutron precursor. In this paper, the above difficulty is overcome by introducing the observer theory for a nonlinear system. The decoupling controller and observer resulted from these theories are applied to the coupled core reactor and the dynamic characteristic of the reactor is simulated by the digital computer. The simulation shows that the reactor power of each core is controlled satisfactorily in decoupling manner.

8206 Absorber rod to control a nuclear reactor with a charge of spherical fuel elements. Angelini, A.; Handel, H.; Landwehr, H.; Schoening, J.; Hammelmann, K. (to Hochtemperatur-Reaktorbau G.m.b.H., Koeln (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). German(FRG) Patent 1,815,916/C/. 24 Mar 1977. 2p. (In German).

A helical absorber rod which can be driven in and out by simultaneous longitudinal and twisting movement is described. The rod acts in the charge of spherical fuel elements like a feed screw, it loosens the particles and avoids non-permissible stressing of the operational elements and reflector equipment.

8207 Protective device for a reactor. Neda, T. (to Tokyo Shibaura Electric Co. Ltd.,). Japanese Patent 1977-112,098/A/. 18 Mar 1976. 8p. (In Japanese).

The object of the invention is to provide a protective device for a boiling water reactor which can prevent a neutron absorber from being dropped. The state whether a neutron absorber of a control rod is removed from the interior of a reactor or not can be judged by reading a neutron flux detector, and in the case where the neutron absorber is disengaged from a drive portion, an operator is informed thereof by an alarm or lamp, and in addition, removal of the control rod is restrained to prevent occurrence of trouble.

8208 Method of operating a reactor. Katayanagi, D.; Masuda, H. (to Hitachi Ltd.). Japanese Patent 1977-112,097/A/. 15 Mar 1976. 7p. (In Japanese).

The object os the method is to effect power control depending on the concentration of xenon within the fuel arranged in a reactor to increase a reactor power and to avoid failure of fuel. A detection signal from a control-rod position detector is routed into a control rod position storing and a control-rod displacement counter, an output there from is routed into a xenon concentration, power and time store which receives a power from a xenon initial concentration and initial power setter, and the xenon concentration is counted on the basis of power therefrom, whereby a control rod drive is operated to increase a reactor power.

8209 Apparatus for increasing the power of a pressure tube reactor. Masuda, H. (to Hitachi Ltd.). Japanese Patent 1977-110,392/A/. 12 Mar 1976. 4p. (In Japanese).

The object of the invention is to improve safety and working ratio of a reactor and to shorten operation days until a rating power is obtained, by minimizing a power increasing velocity and a rate of change in power distribution due to withdrawal of a control rod. A control rod provided with a driving mechanism is arranged at a reflector of a pressure tube reactor. Increase in power is achieved by

drawing the control rod out. When low power is increased, a power equalizing control rod in a reactor is driven. When high power in danger of fuel failure is increased, only a high power-increasing control rod is driven.

ENVIRONMENTAL ASPECTS

REFER ALSO TO CITATION(S) 8928

SITING

8210 (BNL-NUREG—50689(Vol.1), pp 44-46) **Evaluation of vibratory ground motion at nuclear power plant sites.** Hofmann, R.B.; Greeves, J.T. (Nuclear Regulatory Commission, Washington, DC). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The evaluation of vibratory ground motion at nuclear power plant sites requires the cooperative effort of scientists and engineers in several disciplines. These include seismology, geology, geotechnical engineering and structural engineering. The Geosciences Branch of the NRC Division of Site Safety and Environmental Analysis includes two sections, the Geology/Seismology Section and the Geotechnical Engineering Section.

8211 (ORNL/TM—6470) **Hartsville data and analysis book: Phase I.** Kerley, C.R.; Siegrist, C. (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 227p. Dep. NTIS, PC A11/MF A01.

A preconstruction data base is recorded for the impact area surrounding the Hartsville nuclear construction project. The objective is to document baseline information for socioeconomic characteristics that may be either temporarily or permanently altered by the project. The analysis suggests that the five counties surrounding the site make up a primary impact area, but some impacts may occur outside the area. The work force for the construction phase of the project is segregated into four components: (1) former residents of the site county, (2) former residents of other counties in the impact area, (3) in-movers to the site county, and (4) in-movers to other counties in the impact area. A theoretical model is developed to illustrate the contribution of each component to the spatial pattern of economic benefits and social costs in the impact area. A shift-share analysis of agricultural characteristics in the impact area shows that employment and farm numbers in the area have declined at a slightly faster rate than in the nation but at a slower rate than in the South. A population and construction project threshold analysis suggests that, given the project size and population base at Hartsville, significant social and economic constraints may be encountered in the public and private economic infrastructure. These include amenities such as housing, school space, medical and police protection.

8212 **Publication concerning the drafts of three technical safety guidelines for nuclear power plants (Safety Guides) of the International Atomic Energy Agency. Dated March 23rd, 1978.** *Bundesanzeiger;* **30**: No. 63, 2(Apr 1978). (In German).

Amendment proposals for 'Safety Guide on In-Service Inspection (SG - O2)', 'Safety Guide on Operating Limits and Conditions (SG - O3)', and 'Safety Guide on Atmospheric Dispersion in Nuclear Power Plant Siting (SG - S3)'are solicited.

8213 **Technical safety rules of the International Atomic Energy Agency (IAEA) - invitation to comments.** *GRS Kurz-Inf., Reihe C;* No. 25, 1-3(1978). (In German).

Proposals are solicited for amendments to the 'Safety Guide on Site Selection and Evaluation for Nuclear Power Plants with Respect to Population Distribution (SG-S4)'.

RADIOACTIVE EFFLUENTS

REFER ALSO TO CITATION(S) 7506, 7511

8214 **Radioactive materials released from nuclear power plants in 1976.** Decker, T.R. *Nucl. Saf.;* **19**: No. 5, 628-636(1978).

Releases of radioactive materials in airborne and liquid effluents from commercial light-water reactors during 1976 have been compiled and are reported. Data on solid-waste shipments, as well as selected operating information, are included. The report from which this article is adapted supplements earlier annual reports issued by the former Atomic Energy Commission (now DOE) and the Nuclear Regulatory Commission. The 1976 release data are compared with the releases of previous years in tabular form. In all cases the total releases were below the limits set forth in applicable regulations and in the technical specifications for each plant.

8215 **Japan AEC's guide for methods of evaluating compliance with the dose objectives around a site of light-water-cooled nuclear power reactors.** Yoshida, Y.; Iijima, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki, Tokai Research Establishment). *Hoken Butsuri;* **12**: No. 2, 117-126(Jun 1977). (In Japanese).

In 1975, Japan Atomic Energy Commission defined the guide to the dose objective for maintaining as low as practicable the exposure dose for the public by the radioactive waste released from light water-cooled reactors. The dose objective value is under 500 m Rem/year, which is the allowable dose for the public, 5 m Rem/year for the sum of the evaluated value of whole body exposure dose by the γ-ray from radioactive rare gases and that caused by the radioactive matters in liquid wastes, and 15 m Rem/year for the evaluated value of the exposure dose of thyroid gland caused by radioactive iodine. The ions and outs of the determination and calculation of these evaluated values are described in details. Since these evaluated values are based on the principle of "as low as practicable", studies should be continued in order to revise the guide as occasion demands.

CHEMICAL AND THERMAL EFFLUENTS

8216 **Diffusion of condenser water discharge.** Iwakiri, T. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)). *Karyoku Genshiryoku Hatsuden;* **28**: No. 10, 937-946(Oct 1977). (In Japanese).

Thermal and nuclear power stations in Japan are mostly located in coastal areas, and the cooling water is discharged into sea as warm water. Recently, large interest is taken in this matter, and it is desirable to predict the diffusion of warm discharge accurately and to take effective measures for lowering the temperature. As for the methods of predicting the diffusion of warm discharge, simplified estimation, mathematical analysis and hydrographical model experiments are used corresponding to objects and conditions. As for the measures to lower temperature, the method of discharging warm water into deep sea bottom was confirmed to be very effective. In this paper, the phenomena of diffusion of warm discharge in sea, the methods of predicting the diffusion of warm discharge, and the deep sea discharge as the measure for lowering temperature are outlined. The factors concerning the diffusion of warm discharge in sea are the conditions of discharge, topography and sea state, and the diffusion is roughly divided into mixing diffusion in the vicinity of warm water outlet and eddy diffusion in distant region. It is difficult to change artificially the conditions of diffusion in distant region, and the measures of raising the rate of dilution in near region are effective, therefore the deep sea discharge is adopted.

RESEARCH, TEST, AND EXPERIMENTAL REACTORS

REFER ALSO TO CITATION(S) 8076, 8236, 8242, 8269, 8273, 8278

8217 (HEDL-SA—1423) **Fuel pin bundle and hexagonal duct mechanical interaction.** Chan, D.P.; Jackson, R.J. (Westinghouse Hanford Co., Richland, WA (USA)). 1978. Contract EY-76-C-14-2170. 24p. (CONF-780609—13). Dep. NTIS, PC A02/MF A01.

From ASME/CSME pressure vessels and piping conference; Montreal, Canada (25 Jun 1978).

Cause and effect of the fuel pin bundle and the hexagonal duct mechanical interaction are discussed. An analytical method for calculating the bundle compressive stiffness and the pin-to-pin clearance is introduced. Analytical results for bundles of different sizes are compared to the available experimental values. It is concluded that (1) the bundle/duct interactive force and reduction in pin-to-pin clearance can vary over wide ranges due to tolerances on wire tension and wire pitch, (2) the maximum contact force and the maximum reduction in pin-to-pin clearance are more likely to occur near the edge pin than in the interior of a bundle, and (3) FFTF pin bundle will not experience adverse effects of bundle duct mechanical interaction.

8218 (HEDL-TC—517) **Summary stress results for the heat transport system piping and components.** Bartholf, L.W.; Edwards, P.A.; Ketchum, H.B. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.). May 1976. Contract EY-76-C-14-2170. 375p. Dep. NTIS, PC A16/MF A01.

Portions of document are illegible.

8219 (HEDL-TME—78-12) **Small thermal oscillation analysis of the MOTA.** Guthrie, G.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1978. Contract EY-76-C-14-2170. 57p. Dep. NTIS, PC A04/MF A01.

The MOTA (Materials Open Test Assembly) was designed to achieve a degree of thermal regulation compatible with the generation of useful materials property data obtained by irradiation of candidate reactor structural materials in the FFTF. Attaining a high

degree of regulation is limited by the necessity to avoid undamped thermal oscillations. The report documents some of the analyses used to select usable configurations and determine effects of parameter choices, and investigates limitations on allowable gains of the sensor-control-valve assembly. The main purpose of the document is to make the methods available to others, rather than to give a tabulation of specific numerical results.

8220 (NUREG/CP—0004(Vol.1), pp 299-311) **Determination of fuel irradiation parameters required accuracies and available methods.** Mas, P. (CEN, Grenoble, France). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Some main methods to determine the nuclear parameters of fuel irradiation in test reactors (nuclear power, burn up...) are discussed. The different methods (theoretical or experimental) are reviewed: neutronics measurements and calculations, gamma scanning, thermal balance, etc. The required accuracies are reviewed: they are of 3 to 5% on flux, fluences, nuclear power, burn-up, and conversion factors. These required accuracies are compared with the real accuracies available which are at the present time of order of 5 to 20% on these parameters.

8221 (NUREG/CP—0004(Vol.1), pp 333-351) **Intercomparison of the fission power determinations in a fuel pin.** Bruet, M.; Michel, F.; Perdreau, R. (CEN, Grenoble, France). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Three experimental methods of determining the fission power in a fuel pin, during irradiation in the SILOE Research Reactor, have been compared: (1) Radial heat conduction is determined by the measurement of the temperature gradient through fuel cladding, (2) In pile gamma scanning, and (3) Incident neutron flux is monitored by self powered detectors, and calculations of the fission rates have been made by using computer code APOLLO (a one dimensional transport code). The methods are briefly described. The results are in agreement within 6%. This intercomparison is of interest due to the fact that those methods would be used at different steps of the irradiation: previsioning, monitoring, and post irradiation examinations.

8222 (NUREG/CP—0004(Vol.1), pp 353-368) **Continuous parameter determination of irradiated nuclear fuels in the test-reactor.** Bevilacqua, A.; Junod, E.; Mas, P.; Perdreau, R. (CEN, Grenoble, France). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

During the irradiation tests of nuclear fuels, the flux level may often be variable by shifting the loops in a high neutron-gradient. So integral fluence measurements are no longer sufficient. The self-powered neutron detectors allow to finely scan instantaneous fluxes. More than 100 such SPN detectors are used on the experiments irradiated in the SILOE reactor. The treatment of the large amount of information is following. A first minicomputer scans all the measurement lines at a variable frequence (10 min to 1 hr) and writes rough voltage values on a magnetic disk. A second computer does a sorting of these values for each set of SPND corresponding to an experiment. At the present time, the main treatment is performed by batch processing by some FORTRAN codes to get time-evolving quantities, such as effective flux, fission power, burn-up, fission product activities, etc. The future development of the system will allow some of these calculations to be performed directly on the second computer in such a manner to control the movements of the loops automatically in view of a given irradiation program.

8223 (NUREG/CP—0004(Vol.1), pp 369-387) **Role of irradiation reactor mock-ups.** Casali, F. (CNEN, Bologna, Italy); Cerles, J.M.; Debrue, J. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

A survey is given of the utilization of low power facilities in support to irradiation reactor experiments. The BRO2, ISIS and RB3 facilities are described as neutronic mock-ups of the BR2, OSIRIS and ESSOR reactors respectively.

8224 (NUREG/CP—0004(Vol.2), pp 637-651) **Calculations and measurements of fast neutron spectrum in a research reactor.** Lloret, R.; Perdreau, R.; Tran-Dai-Phuc. (CEN, Grenoble, France). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

An experimental program has been undertaken to confirm fast neutron spectrum calculations. The verification of calculational methods consists of comparing the measurements in a highly heterogenous media to two dimensional calculations effectuated on approach geometries. The measurements have been carried out in two testing rigs located in the center of the core and near the reflector of the Melusine Pool-type reactor. Counting techniques used for the determination of the reaction rate by beta-gamma activity measurements and activation foils are described. The following reactions have been selected: $^{197}Au(n,\gamma)^{198}Au$, $^{115}In(n,n')$/sup 115m/In, $^{47}Ti(n,p)^{47}Sc$, $^{58}Ni(n,p)^{58}Co$, $^{54}Fe(n,p)^{54}Mn$, $^{46}Ti(n,x)^{46}Sc$, $^{56}Fe(n,p)^{56}Mn$, $^{63}Cu(n,\alpha)^{60}Co$, $^{27}Al(n,\alpha)^{24}Na$, $^{92}Nb(n,2n)$/sup 92m/Nb, $^{58}Ni(n,2n)^{57}Ni$. A spectrum form has been elaborated from such activities by using the unfolding code SAND-II. On the other part, spectrum determinations are performed with Transport codes ANISN and DOT-III. The spectrum obtained from Unfolding and Transport Codes has been compared. Good agreement between the measured (foil activation) and calculated (SAND-II) activities was found with all detectors. Reasonable (SAND-II) solutions are observed in the two test cases.

8225 (NUREG/CP—0004(Vol.2), pp 667-682) **Determination of appropriate neutron spectra in the CALIBAN pulsed reactor: iterative method applied to activation and fission detectors.** Morin, J. (CEA, Is-sur-Tille, France); Dorlet, J. 1977. (In French).

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

CALIBAN reactor is designed to operate either in the pulsed mode or in the steady state mode. The core is a vertical cylinder of enriched uranium, in two halves of about the same volume: one is fixed, and the other moved by a fast-retraction device. Reaction rates from 10 detectors, including: metallic foils (^{103}Rh; ^{115}In; ^{58}Ni; ^{56}Fe; ^{27}Al; ^{24}Mg) and fission chambers (^{238}U; ^{235}U; ^{237}Np; ^{239}Pu) have been measured in the glory hole and outside the core. By an iterative method, from these reaction rates, a solution spectrum determination has been made on each of the measuring points. The spectrum shape is an appropriate one, which allows to foresee reaction rates of any detector placed on these points.

8226 (NUREG/CP—0004(Vol.2), pp 683-698) **Neutron dosimetry and spectral measurements at the White Sands Missile Range fast burst reactor.** Wright, H.L. (White Sands Missile Range, NM); Meason, J.L.; Harvey, J.T. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The neutron dosimetry techniques and results from neutron spectral measurements of the White Sands Missile Range Fast Burst Reactor are reported. Characteristics of the neutron spectrum have been studied over the past several years as a result of measurements utilizing activation detector methods. The neutron output characteristics of the Fast Burst Reactor take the form of spectral measurements of free-field conditions, spectral measurements of perturbed environments and spectral parameters useful in describing test conditions.

8227 (NUREG/CP—0004(Vol.2), pp 699-712) **Spectrum and dose calibrations of controlled neutron fields at the APRF critical assembly.** Kazi, A.H. (Army Pulse Radiation Facility, Aberdeen Proving Ground, MD); Davis, G.S.; Heimbach, C.R. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The Army Pulse Radiation Facility Reactor (APRFR), a mobile bare critical assembly, is a versatile neutron source well suited for evaluating spectrum and dose data. A number of controlled neutron fields are being established at APRF involving a complete characterization in terms of fluence, spectrum and dose. These exposure fields range from a 106 mm diameter in-core irradiation cavity to an air-over-ground traverse to greater than 200 m from core center. These fields are useful for the irradiation of diverse material under well controlled exposure conditions and serve as

secondary calibration points for various diagnostic instrumentation and calculations.

8228 (NUREG/CR—0231) **Development of the loft prototype drag screen: air-water testing.** Fincke, J.R. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1978. Contract EY-76-C-07-1570. 59p. (TREE-NUREG—1198). Dep. NTIS, PC A04/MF A01.

A prototype full flow drag screen suitable for the loss-of-fluid test (LOFT) environment was developed and tested in steady state two component air-water flow. The use of Pitot tubes as reference instruments for the interpretation of two-phase flow fields was also developed and tested. Both measurement systems were found to measure total mass flow with 6 percent of full-scale accuracy over the following parameter ranges in steady state, air-water flow: (1) pressure—0.379 MPa, (2) temperature—38°C, (3) void fraction—0 to 1.0; (4) superficial gas velocity--0.36 to 12.8 m/s; and (5) superficial liquid velocity--0.3 to 6.1 m/s.

8229 (SAND—78-1273C) **New neutron simulation capabilities provided by the Sandia Pulse Reactor (SPR-III) and the Upgraded Annular Core Pulse Reactor (ACPR).** Choate, L.M.; Schmidt, T.R. (Sandia Labs., Livermore, CA (USA)). [nd]. Contract EY-76-C-04-0789. 11p. (CONF-780707—4). Dep. NTIS, PC A02/MF A01.

From IEEE radiation effects conference; Albuquerque, NM, USA (18 Jul 1978).

The paper briefly describes the nuclear reactor facilities at Sandia Laboratories which are used for simulating nuclear weapon produced neutron environments. These reactor facilities are used principally in support of continuing R and D programs for the Department of Energy/Office of Military Application (DOE/OMA) in studying the effects of radiation on nuclear weapon systems and components. As such, the reactors are available to DOE and DOD agencies and their contractors responsible for the radiation hardening of advanced nuclear weapon systems. Emphasis is placed upon two new reactor simulation sources; the Sandia Pulse Reactor-III (SPR-III) Facility which enhances the neutron exposure volume capabilities over those presently available with the existing SPR-II Facility, and the Upgraded Annular Core Pulse Reactor (ACPR) Facility which enhances the neutron exposure capabilities over those of the former ACPR Facility.

8230 (SAND—78-1305C) **Thin-film fission thermocouples: a new detector for reactor safety experiments.** Wright, S.A.; Knauss, G.L. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 7p. (CONF-781105—37). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The large number of reactor safety experiments planned and performed both in this country and abroad has prompted the need for high temperature fast response miniature neutron detectors. These detectors are needed for time dependent energy deposition monitors, spectrum monitors, or for in-core fuel motion monitors. Sandia Laboratories is investigating the use of thin-film fission thermocouple detectors for these applications. Several of these detectors have been built and successfully tested in the Sandia Pulse Reactor, SPR-III.

8231 (TREE—1250(Vol.1)) **Decontamination and decommissioning long range plan: Idaho National Engineering Laboratory.** Chapin, J.A.; Hine, R.E. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1978. Contract EY-76-C-07-1570. 134p. Dep. NTIS, PC A07/MF A01.

The purpose of this document is to provide long-range planning for decontaminating and decommissioning of radioactive facilities at the Idaho National Engineering Laboratory (INEL). This plan will be revised and updated annually. The information developed during the decontamination and decommissioning (D and D) program will be collected and used to develop a handbook of D and D activities that will be updated annually and made available for the nuclear D and D community. Volume I is the management plan which includes schedules, costs, priorities, criteria, alternatives, and program management philosophy. Costs are order-of-magnitude and schedules are based on program operations through FY 1984.

8232 (ANL-Trans—1139) **Objectives of programs for renovating and increasing the power of research reactors.** Merchie, F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Aug 1978. Translation of conference paper, renovating research reactors and increasing their power, IAEA, Vienna, Austria, May 23-26, 1978. (CONF-780538—5). 23p. Dep. NTIS, PC A02/MF A01.

From Symposium on nuclear activation techniques in the life sciences; Vienna, Austria (22 May 1978).

Portions of document are illegible.

Programs for renovating research reactors and increasing their power have several objectives: (1) the quest for high available fluxes to respond to changes in the needs of the various users, (2) improving flux quality and the characteristics of the experimental facilities; and (3) maintaining the reactor in good condition and placing it in conformance with new safety criteria. These objectives may be researched separately from one another, but they are frequently mixed. In particular, the reactors of the swimming-pool type, which are the most widely used research reactors, offer many possibilities. They were originally designed for medium powers of 1 to 2 MW to be used for the production of radioisotopes and for basic research using the channels. Because of the ease of access to their cores, they were very soon used in France for irradiating materials. This type of irradiation rapidly required higher fluxes. To respond to these needs, the SILOE (35 MW) and OSIRIS (70 MW) made a remarkable beginning towards higher powers, thus opening the road to other reactors in France and in foreign countries. At the present time, because of the age of their reactor equipment, many countries are planning restoration operations coupled with increases in nominal power in order to be able to respond to changes in the needs of their present and future users. The means of obtaining the objectives listed are discussed in detail.

8233 (ANL-Trans—1138) **Replacement of the high enrichment fuel in research piles with low or medium enrichment uranium.** Schwartz, J.P. (International Atomic Energy Agency, Vienna (Austria)). Aug 1978. Translation of conference paper, renovating research reactors and increasing their power, IAEA, Vienna, Austria, May 23-26, 1978. (CONF-780538—4). 7p. Dep. NTIS, PC A02/MF A01.

From Symposium on nuclear activation techniques in the life sciences; Vienna, Austria (22 May 1978).

Two different approaches can be taken to replacing the uranium containing 90 or 93 percent U^{235} which is currently used in research reactors, depending on the level of enrichment desired and the technology utilized. The U-Al technology used for existing elements can be retained. Enrichment will then be in the range of 20 to 40 percent, depending on the type of reactor and the use made of it. This decrease in enrichment must then be compensated, at least in part, by an increase in the mass percentage of uranium in the U-Al composite and by increasing the thickness of the fuel core proper. This results in an adequate mass of ^{235}U in the assembly. It is possible to convert to a technology using UO_2 oxide canned in Zircaloy. Enrichment is then in the range of 3 to 8 percent. The low enrichment is compensated by the high density of the fuel composite (10.2 g/cm³ for the UO_2 oxide as compared to approximately 3 g/cm³ for UAl). To take off power generated at high volumetric power levels, the fuel must be used in the form of plates. The problem of designing a new fuel assembly is generally couched in similar terms for the two fuels. However, the concrete constraints on practical application are particular to each technology and require specific solutions.

8234 **Sorption of fission products on surface of loop contour.** Samsonov, B.V.; Frei, A.K.; Kuleshova, Yu.F. *Radiokhimiya;* **19**: No. 6, 799-806(1977). (In Russian).

Distribution of the fission products has been studied in a loop contour of the atomic reactor with the aid of the unique procedure residing in that the samples of a coolant have been taken periodically from a "small' water loop of the reactor SM-2 where a defect fuel element has been placed with a known value of the open fuel surface, i.e. with a known amount of fission products yield in the coolant. The amount of fission products sorbed on the surfaces of rustproof tubes of the contour has been calculated. The treatment of the results makes it possible to develop a sorption model for the fission products from water low parameter and to determine the coefficients of sorption on a rustproof surface of the contour at neutral pH.

8235 **Epithermal index inside the P Moata Reactor Facility.** Kuanowo, A.; Subki, I. (Bandung Reactor Center (Indonesia)). *Majalah BATAN;* **8**: No. 1, 15-27(Apr 1975). (In Indonesian).

From Workshop on nuclear instrumentation and radiation measurement methods; Bandung, Indonesia (28 Apr 1975).

The epithermal index, $r\sqrt{T}/To$ was measured inside the P' Moata reactor facility by using resonance detector, Au^{197}, W^{186}, In^{115}, and Mn^{55}. Moata is 10KW, Argonaut type reactor, with 1,5 x 10^{11} n cm^{-2} sek^{-1} thermal flux, installed in Lucas Heights, Sydney, owned by the Australian Atomic Energy Commission. The neutron spectrum was assumed to consist of Maxwellian diatribution to which it smoothly joined 1/E slowing down spectrum. By measuring the cadmium ratio (Rsub(c,d)) for each foils, the epithermal index value was then calculated from the following equation $r\sqrt{T}/To$ = Gsub(th)/(FRsub(cd)-.1)Ssub(o)Gsub(r)/g+Rsub(c,d)(1/K - W).Cadmium ratio for foil was measured using a cadmium box of 0,5 inches diameter and 0,015 inches thick.

PLUTONIUM AND ISOTOPE PRODUCTION REACTORS

REFER ALSO TO CITATION(S) 8290, 8834

8236 (CONF-781105—6) **LOFT fuel rod thermal/mechanical behavior predictions.** Niebruegge, D.A.; Tolman, E.L.; Solbrig, C.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 5p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Best-estimate predictions of LOFT fuel rod behavior during the first LOFT nuclear test series have been made with both RELAP/FLOOD4/FRAP-T and RELAP/SCORE/MOXY computer code combinations. The purpose of the predictions are to test the best-estimate code accuracy by comparison of predictions to subsequent test data and to develop plans for post-test fuel replacements and examinations. The FRAP-T3 computer code was utilized which couples the thermal, mechanical, internal gas, and material property behavior of a nuclear rod during various postulated accident sequences. The cladding deformation models account for elastic-plastic behavior. FRAP-T3 requires coolant conditions to be specified as input boundary conditions. The coolant conditions for the blowdown and refill phases of a loss-of-coolant experiment (LOCE) were calculated with RELAP4/MOD6 and for the reflood portion with FLOOD4.

8237 (NUREG/CP—0004(Vol.2), pp 653-666) **Experimental evaluations of neutron spectra for a critical facility by multi-foil activations.** Kondo, I. (Japan Atomic Energy Research Inst., Oarai). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

An evaluation of neutron spectrum for reactor irradiations has been performed experimentally by multifoil activations with the use of a critical facility. Selfshielding corrections for resonance detectors has been tried on the original cross section data. Some of the detectors proved to give activities almost exactly.

8238 (UNI—670) **Nuclear criticality calculations of monotubes.** Benjamin, E.L. (United Nuclear Industries, Inc., Richland, WA (USA)). 30 Jun 1978. Contract EY-76-C-06-1857. 5p. Dep. NTIS, PC A02/MF A01.

The document defines the infinite multiplication factors to support nuclear criticality safety evaluations for N-reactor fuel storage in monotubes in the racks in Room 29 under various conditions of moderation.

PROPULSION REACTORS

REFER ALSO TO CITATION(S) 8317, 8318

8239 **Nuclear powered freight ships - safe and reliable.** Schafstall, H.G. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Anlagentechnik). *Atomwirtsch., Atomtech.;* **23**: No. 4, 184-185(Apr 1978). (In German).

The five nuclear-powered ships built in the world so far have entered over 100 ports in 14 countries about 1000 times in 15 years, during which there were no accidents endangering the safety of a ship. However, for the expansion of freight shipping with nuclear power, comprehensive international regulations for safety requirements, responsability etc., are necessary, whose absence is now a drawback. Although the NEA/IAEO symposium excluded economic questions on the safety of nuclear powered ships, the trends rgarding further development in individual countries became clear.

8240 **Nuclear energy research ship NS Otto Hahn - operation until 1982. Recommendation of the Reaktorsicherheitskommission during its 127th meeting on October 19, 1977.** *Bundesanzeiger;* **30**: No. 51, 1-2(Mar 1978). (In German).

With addendum dated August 24, 1976 to the licence, an operation licence until August 31, 1982 was granted for NS Otto Hahn. In this context the licensing authorities had ordered a guideline comparison to be carried out on the basis of the RSK guidelines for PWRs. Despite the fact that some of the guidlines issued for stationary PWRs connot be adhered to, the RSK recommends operation until 1982, as hazards pursuant to section 17, sub-section 5 of the Atomic Energy Act are not to be expected.

8241 **Study on the thermohydraulic characteristics of marine nuclear reactors. 3. Effect of vertical motion on the critical heat flux at relatively high quality region.** Otsuji, T.; Kurosawa, A. (Kobe Univ. of Mercantile Marine (Japan)); Hanabata, S.; Iwahori, K. *Kobe Shosen Daigaku Kiyo. Dai-2-rui. Kokai, Kikan, Rigaku-hen;* No. 25, 115-121(Jul 1977). (In Japanese).

Critical heat flux(CHF) of Freon-113 flowing vertically upward under periodically oscillating gravity field were obtained experimentally. The test section is a 10 x 22 x 1300mm annular channel, and the heater is uniformly heated by electric current. Pressure was 3kg/cm^2 abs, mass flux was 1.83 x 10^6 or 3.51 x 10^{6}kg/m^{2}h, inlet subcooling 1 to 27°C, and nominal acceleration amplitude 0 to 0.5g. In general, as acceleration amplitude increase, CHF decrease smoothly. When the test loop is moved, CHF phenomena become indistinct due to oscillating behavior of CHF detector output. This oscillation is regarded as a result of time variation of the dry-out boundary.

REACTOR SAFETY

8242 (ANL—78-69) **Combined motion of fuel and coolant due to fuel-coolant interactions under high ramp rate reactivity insertion.** Chang, K.I.; Cho, D.H. (Argonne National Lab., IL (USA)). Jul 1978. Contract W-31-109-ENG-38. 52p. AT.

An analysis has been made of the combined motion of fuel and coolant due to fuel-coolant interactions following a massive fuel failure in a high-ramp overpower transient. The motion of fuel and coolant was described using a two-fluid model formulation in which the mixture of sodium liquid and vapor and of fission gas, on the one hand, and the fuel particles, on the other, were treated as two superimposed continua. The method of solution employed was a numerical procedure called the ACE method, a modified version of the IMF technique. Illustrative calculations were made for a fuel rupture length of 60 cm in the FFTF geometry. Three different modes of fragmentation were considered. First, upon pin failure, molten fuel is completely fragmented and uniformly distributed in the coolant (uniform fragmentation). Second, fragmentation is initiated at the bottom of the mixing zone and propagates upward (bottom-initiated progressive fragmentation). Third, fragmentation is initiated at the top of the mixing zone and propagates downward (top-initiated progressive fragmentation).

8243 (BNL—24589) **Lumped-parameter modeling of PWR downcomer and pressurizer for LOCA conditions.** Rohatgi, U.S.; Saha, P.; Dubow, A.A. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 10p. (CONF-781022—16). Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

Two lumped-parameter models, one for a PWR downcomer and the other for a pressurizer, are presented. The models are based on the transient, nonhomogeneous, drift-flux description of two-phase flow, and are suitable for simulating a hypothetical LOCA condition. Effects of thermal nonequilibrium are incorporated in the downcomer model, whereas the pressurizer model can track the interfaces among various flow regimes. Semi-implicit numerical schemes are used for solution. Encouraging results have been obtained for both the models.

8244 (BNL-NUREG—50689(Vol.1)) **Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.** (Nuclear Regulatory Commission, Washington, DC (USA)). Apr 1978. Contract EY-76-C-02-0016. 325p. (CONF-770929—P1). Dep. NTIS, PC A14/MF A01.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

Volume I contains 17 papers, each of which has been separately processed for the Energy Data Base. (DG)

8245 (BNL-NUREG—50689(Vol.1), pp 15-19) **Outline of U.S. research structure for HTR safety.** Schamberger, R.D. (Nuclear Regulatory Commission, Washington, DC). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

Brief comments are made on the direction and the support for high temperature gas-cooled reactor research and development in the United States.

8246 (BNL-NUREG—50689(Vol.1), pp 20-27) **Overview of the U.S. seismic research program.** Harbour, J.; Schamberger, R.D. (Nuclear Regulatory Commission, Washington, DC). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

A brief survey discussion is presented which touches on a number of topics which are related to the dynamic response of nuclear systems. The principal emphasis is on high temperature graphite-moderated helium-cooled reactors and on the seismic excitation mechanism.

8247 (BNL-NUREG—50689(Vol.1), pp 28-43) **Overview of Japanese seismic research program for HTR.** Ikushima, T. (Japan Atomic Energy Research Inst., Tokai). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

In order to obtain the license for construction and operation of HTR developed in and/or introduced into Japan, it is necessary to insure the integrity of reactor structures and the capability of reactor shutdown and the maintenance of safety shutdown for the seismic design condition. Because Japan is located in relatively high seismicity zone, even when an excessive earthquake would occur, the public and plant personnel should be protected from radiation hazard. The report describes the following: (1) present status of development and construction plan of HTR, (2) guideline of aseismic design, (3) need of aseismic research, (4) present status of research and development, and (5) future plans.

8248 (BNL-NUREG—50689(Vol.1), pp 47-61) **Experimental and analytical studies on soil-structure interaction behavior of nuclear reactor building.** Tsushima, Y. (Takenaka Technical Research Lab., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The purpose of this study is to estimate damping effects due to soil-structure interaction by the dissipation of vibrational energy to the ground through the foundation in a building with a short fundamental period such as a nuclear reactor building. The author performed experimental and analytical studies on the vibrational characteristics of model steel structures ranging from one to four stories high erected on the rigid base and located on soil, which are simulated from the vibrational characteristics of a prototype reactor building: the former study is to obtain damping effects due to inner friction of steel frames and the latter to obtain radiation damping effects due to soil-structure interaction. The author also touches upon the results of experiments performed on a BWR-type reactor building in 1974, which showed damping ratios higher than 20% of those in fundamental modes. Then the author attempts to estimate the damping effects of the reactor building by his own method proposed in the report. Through these studies the author finally concludes that the experimental damping effects are remarkable in the lower modes by the energy dissipation and the analytical results show a fairly good fit to the experimental ones.

8249 (BNL-NUREG—50689(Vol.1), pp 62-74) **Study on the seismic verification test program on the experimental multi-purpose high-temperature gas cooled reactor core.** Taketani, K. (Japan Atomic Energy Research Inst., Tokai); Aochi, T.; Yasuno, T.; Ikushima, T.; Shiraki, K.; Honma, T.; Kawamura, N. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The paper describes a program of experimental research necessary for qualitative and quantitative determination of vibration characteristics and aseismic safety on structure of reactor core in the multipurpose high temperature gas-cooled experimental reactor (VHTR Experimental Reactor) by the Japan Atomic Energy Research Institute.

8250 (BNL-NUREG—50689(Vol.1), pp 88-100) **Seismic tests on the HTGR with the prismatic core.** Ide, A.; Ishizuka, H.; Hayakawa, H.; Shingai, K. (Fuji Electric Co., Ltd., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

A basic study on the seismic response of the core of the block type fuel Very High Temperature Reactor was carried out with a one-dimensional array of 10 cm cubic blocks, a two-dimensional horizontal section model, single and double column consisting of $1/5$ scale hexagonal graphite fuel blocks. Simulation analyses by the digital computer were also carried out to examine the effectiveness of computational approach. A simple empirical formula and a good correlation between experimental and analytical results were obtained for the seismic response of a one-dimensional model. On the horizontal model, an analogy to the one-dimensional model was observed, and on the column models, the resonance and other column characteristics were obtained.

8251 (BNL-NUREG—50689(Vol.1), pp 114-125) **Vibration tests of a commercial gas cooled reactor core.** Yamahara, H. (Shimizu Construction Co. Ltd., Tokyo); Hayakawa, H. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

In the seismic design of a nuclear power plant, the structures and equipments of the plant including foundation soil are represented by an equivalent mathematical model, and the deflections and stresses during earthquake are analyzed. In the analysis, the dynamic properties of various elements that influence on the dynamic behavior of the plant are examined. The damping constant assumed in the analysis plays an important role to determine the response amplitude of core. The effect of damping may even be more important than the effects of stiffness, mass, and other factors for the determination of the amplitude of core response. The damping has been generally assumed to take a value within a range from 1 to 5% of the critical from our empirical judgment for ordinary structures. However, these two extreme values lead to two or three times difference between the peak amplitudes of the response. Because the damping is not accurately known, it has been common practice to take a conservative value, generally less than 2% for the dynamic analyses of core. This is undesirable from the economical point of view if the damping is estimated too little. Under those circumstances, much attention of the persons concerned had been directed toward obtaining a right knowledge of the damping characteristics of core. That became a direct motive to scheme and practice the full scale model test for the commercial gas cooled reactor core that was under construction at Hunterston in Scotland. This experiment was carried out August 1972 in cooperation with the Nuclear Power Group Ltd. in United Kingdom, Fuji Electric Co. Ltd. and Shimizu Construction Co. Ltd. in Japan.

8252 (BNL-NUREG—50689(Vol.1), pp 137-149) **One stacked-column vibration test and analysis for VHTR core.** Taketani, K. (Japan Atomic Energy Research Inst., Tokai); Aochi, T.; Yasuno, T.; Ikushima, T.; Ishizuka, H.; Ide, A.; Hayakawa, H.; Shingai, K. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The paper describes experimental results of the vibration test on a single stacked-column and compares them with the analytical results. A $1/2$ scale model of the core element of a very high temperature gas-cooled reactor (VHTR) was set on a shaking table. Sinusoidal waves, response time history waves, a beat wave and a step wave of input acceleration 100 to 900 gal in the frequency of 0.5 to 15 Hertz were used to vibrate the table horizontally. Results are as follows: (1) the column has a nonlinear resonance and exhibits a hysteresis response with jump points; (2) the column vibration characteristics is similar to that of the finite beams connected with nonlinear soft spring; (3) the column resonance frequency decreases with increasing input acceleration; (4) the impact force increases with increasing input acceleration and boundary gap width; (5) good correlation in vibration behavior of the stacked column and impact force on the boundary between test and analysis was obtained.

8253 (BNL-NUREG—50689(Vol.1), pp 177-188) **Two-dimensional vibration test and its simulation analysis for a vertical slice model of HTGR core.** Muto, K. (Muto Inst. of Structural Mechanics, Inc., Tokyo); Uchida, K.; Takase, H.; Kasai, Y.; Kuroda, T.; Murakami, H. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The core of a large HTGR (1100 MWe) is contained in a thick reinforced concrete pressure vessel. The core is made up of 577 hexagonal graphite columns (about 8,000 blocks) and the circumference of the core consists of 36 irregularly-shaped graphite reflectors (about 450 blocks). All blocks are arrayed horizontally with a 4 millimeter clearance between each block and are stacked vertically in 13 layers. It is expected that seismic behavior of the core can be extremely complicated due to inter-block collisions. The paper describes the vibration test and its simulation analysis of the two-dimensional vertical slice model which was conducted in 1975 as a follow-on research for the one-dimensional vibration test in 1974. A vertical slice (25 block columns and 2 reflector columns) across the center of the core was selected, and the forced vibration test of a $1/5$ scale model was performed by using a shaking table to obtain such dynamic properties as frequency characteristics and vibration modes of the core, lumping and collision patterns of blocks and the response distribution of reflector reactions. Together with the test, a computer code called COLLAN2-V was developed to simulate the test results. Consequently, it was clarified that the collision behavior of the core could be analyzed by the computer.

8254 (BNL-NUREG—50689(Vol.1), pp 189-202) **Two-dimensional vibration test and its simulation analysis for a horizontal slice model of HTGR core.** Muto, K. (Muto Inst. of Structural Mechanics, Inc., Tokyo); Uchida, K.; Takase, H.; Kasai, Y.; Kuroda, T.; Murakami, H. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The paper describes the vibration test and its simulation analysis of the two-dimensional horizontal slice model of a large HTGR core. The test was conducted in 1976 as a follow-on research for the two-dimensional vertical slice model test in 1975. A horizontal slice (577 blocks and 18 reflectors) across the middle height of the core was selected, and the forced vibration test of a 1/5 scale model was performed by using a shaking table to obtain such dynamic properties as frequency characteristics and vibration modes of the core, lumping and collision patterns of blocks and the response distribution of reflector reactions. Together with the test, a computer code called COLLAN2-H was developed to simulate the test results. Consequently it was found that the analytical reflector reactions coincide fairly with the experimental values.

8255 (BNL-NUREG—50689(Vol.1), pp 234-246) **Aseismic design and it's test of multiwalled pipings for an elevated temperature helium gas cooling system.** Suzuki, M. (Kawasaki Heavy Industries, Ltd., Tokyo); Kobatake, K.; Ooka, Y.; Katsuki, T.; Okuda, T.; Tanaka, T.; Baba, O.; Takahashi, H. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

Multiwalled pipings are used for the inpile gas loop, named "OGL-1", of which maximum helium gas temperature is 1,000°C. Authors carried out the vibration test of the inpile tube and the multiwalled pipings, and obtained the natural frequencies and damping ratios of which were compared with the design values. It is confirmed that the vibration of the inpile tube is not induced by the cooling water flow. After the vibration test, the multiwalled pipings are analyzed further as single-walled pipings using some assumptions which are included in the effect of the supporting structure. The obtained natural frequencies and vibration modes by analyses coincide with the measured values. The obtained damping ratio of the multiwalled pipings and tube shows the design value 0.5% is very conservative.

8256 (BNL-NUREG—50689(Vol.1), pp 255-267) **Seismic response of some components on VHTR and nuclear steel making system.** Nakagawa, E.; Ando, K.; Sugita, T.; Azuma, T. (Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

In order to establish the highly reliable design of heat exchanger and circulator in VHTR and the nuclear steel making system, seismic response calculations were conducted. First, the numerical calculation by the finite element method and the model experiment for the seismic analysis in heat exchanger tubes of helical type and structure of three dimensional frame to support the heat exchanger and other equipments were carried out. A real-sized model was used for the experiment in the heat exchanger and 1 : 9 scale model was used in the supporting structure. It was found that the calculated values agreed well with the experimental values. Next, transient response of the circulator rotor supported in water-lubricated hydrostatic journal bearings to seismic input was investigated numerically by Runge-Kutta-Gill procedure. Numerical results for the rotor which is equivalent to helium circulator for high temperature helium test loop with heat exchanging capacity 1.5 MWt are presented and the effects of operating conditions of the bearing on rotor response are discussed.

8257 (BNL-NUREG—50689(Vol.1), pp 298-309) **Inelastic response of PCRV structure model with star-type support under horizontal loads.** Suzuki, T.; Yamaguchi, T.; Takeda, T. (Technical Research Inst., Tokyo). Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume 1. Seismic research.

The report presents the test results of scaled models for prestressed concrete reactor vessel (PCRV) structure with star-shaped support under horizontal loads. A scale factor of $1/_{70}$ to a proto-type PCRV structure for large HTGR is used for both static and dynamic loading test models, while a $1/_{15}$ scaled model is used for static loading tests. The static behaviors such as a load-deflection envelope of the $1/_{70}$ model are predicted well by an inelastic analysis in consideration with appearance of concrete cracks and reinforcing bar yielding. It is also ascertained by the test results of the $1/_{15}$ model under static alternative loads that the same analysis procedure can be applicable to the evaluation of the elastic and inelastic behaviors of PCRV structure with support. Based on the static loading test results of both scaled models, a tri-linearized load-deflection envelope and an equivalent linearized mathematical model for hysteresis loop are assumed in a dynamic analysis. A dynamic response analysis of the $1/_{70}$ model subjected to earthquake-like base motion is conducted by the similar manner above-mentioned and the calculated results show a good correlation with the test results.

8258 (BNL-NUREG—50689(Vol.2)) **Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.** (Nuclear Regulatory Commission, Washington, DC (USA)). Apr 1978. Contract EY-76-C-02-0016. 351p. (CONF-770929—P2). Dep. NTIS, PC A16/MF A01.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

Included are nineteen papers, each of which has been separately processed for the Energy Data Base. (DG)

8259 (BNL-NUREG—50689(Vol.2), pp 86-107) **Model for the processes which lead to layering and the possible formation of combustible mixtures in an HTGR containment vessel following a depressurization accident.** Strehlow, R.A. (Univ. of Illinois, Urbana); Sibulkin, M. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

The paper contains an analysis of the consequences of a catastrophic accident involving a massive upper penetration failure of the PCRV in an HTGR. During blowdown the jet mixing process causes the contents of the containment vessel (CV) to be strongly layered with the upper half containing a mixture of approximately 70% helium and 30% air and the lower half containing essentially pure air. Three possible occurrences subsequent to the initial blowdown are examined. The first of these is the normal buoyant exchange that would occur between the hot core gases and the CV air above the upper penetration leak. In this calculation it is assumed that all the air that enters the CV reacts with the hot graphite core to produce a carbon monoxide-nitrogen-helium mixture and that some of this mixture egresses into the CV due to the continuing buoyant exchange process. In the second case it is assumed that a lower penetration occurs subsequent to the upper penetration. This also allows buoyant exchange between the PCRV and CV. However, in this case, the exchange is more rapid because the driving force is larger. The third type of behavior subsequent to blowdown involves the occurrence of a steam leak into the PCRV either at the same time or somewhat after the occurrence of the blowdown. In this case, it is assumed that the steam reacts completely with the hot graphite core to produce a hydrogen-carbon monoxide-helium mixture and that some of this mixture then egresses into the CV. As a consequence of the layering that occurred during the initial blowdown and of the subsequent layering of the combustible gases in the region that contains essentially pure air, it is shown that for all three cases a gas whose composition is extremely close to the best current estimate of conventional combustibility limits may be formed in a layer which lies slightly above the top surface of the PCRV.

8260 (BNL-NUREG—50689(Vol.2), pp 120-142) **Analysis of gas mixing in the HTGR containment following depressurization.** Takahashi, H. (Brookhaven National Lab., Upton, NY); Omata, I.; Skalyo, J. Jr.; Huber, P. Apr 1978.

From Seminar on HTGR safety technology; Upton, NY, USA (15 Sep 1977).

In Proceedings of the Japan—U.S. seminar on HTGR safety technology. Volume II. Helium technology.

Helium gas mixing with the air in the containment vessel of a High Temperature Gas-Cooled Reactor (HTGR) following a depressurization is analyzed with a layering model using the HAZARD code. To study the applicability of the layering model to this problem, the circulatory motion of the mixed gas in the containment has been analyzed by a newly developed code, CIRC. It is shown that the gas circulates only in the upper part of the containment vessel. In order to study the mixing, a small scale experiment is proposed and the dimensional analysis for the model simulation is discussed.

8261 (BNL-NUREG—50773) **Advanced thermohydraulic simulation code for transients in LMFBRs (SSC-L code).** Agrawal, A.K. (Brookhaven National Lab., Upton, NY (USA)). Feb 1978. Contract EY-76-C-02-0016. 331p. Dep. NTIS, PC A15/MF A01.

Physical models for various processes that are encountered in preaccident and transient simulation of thermohydraulic transients in the entire liquid metal fast breeder reactor (LMFBR) plant are described in this report. A computer code, SSC-L, was written as a part of the Super System Code (SSC) development project for the "loop"-type designs of LMFBRs. This code has the self-starting capability, i.e., preaccident or steady-state calculations are performed internally. These results then serve as the starting point for the transient simulation.

8262 (CONF-781022—2) **Upper plenum energency core coolant (ECC) injection in the semiscale Mod-1 system.** Harvego, E.A.; Loomis, G.G. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 9p. Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

Two different PWR plant configurations were simulated in the Semiscale Mod-1 system. The first system configuration represented a double-ended cold leg break in one loop of a four-loop PWR plant. Accumulators injected ECC into both the upper plenum and the cold legs, and two different upper plenum ECC injection rates were evaluated. For the second simulation, the Semiscale Mod-1 system was configured to represent a double-ended cold leg break in one loop of a two-loop PWR system. In this case, ECC was injected by the low pressure injection system (LPIS) into the upper plenum, and accumulator water was injected into the intact and broken loop cold legs. This injection technique is similar to that used in several American-made two-loop PWRs.

8263 (CONF-781022—3) **PWR subcooled blowdown analysis using a two-dimensional equivalent piping network to calculate asymmetric core barrel loadings.** Berry, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 12p. Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

The paper examines the asymmetric core barrel loadings associated with the postulated LOCA of a typical PWR. Pressure and pressure difference histories for various points in the modeled PWR primary coolant system form the output from this subcooled blowdown analysis. These histories may then be utilized to generate forcing functions for use in a structural-dynamic analysis of the PWR system.

8264 (CONF-781022—11) **Steam—water mixing in nuclear reactor safety loss-of-coolant experiments.** Naff, S.A.; Schwarz, W.F. (EG and G Idaho, Inc., Idaho Falls (USA); Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office). 1978. Contract EY-76-C-07-1570. 8p. Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

Computer models used to predict the response of reactors to hypothesized accidents necessarily incorporate approximating assumptions. To verify the models by comparing predicted and measured responses in test facilities, these assumptions must be confirmed to be realistic. Recent experiments in facilities capable of repeatedly duplicating the transient behavior of a pressurized water reactor undergoing a pipe rupture show that the assumption of complete water-steam mixing during the transient results in the predicted decompression being faster than that observed. Water reactor safety studies currently in progress include programs aimed at the verification of computer models or "codes" used to predict reactor system responses to various hypothesized accidents. The approach is to compare code predictions of transients with the actual test transients in experimental facilities. The purpose of this paper is to explain an important instance in which predictions and data are not in complete agreement and to indicate the significance to water reactor safety studies.

8265 (CONF-781022—13) **Uncertainty analysis of the FRAP code.** Peck, S.O. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 9p. Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

A user oriented, automated uncertainty analysis capability has been built into the Fuel Rod Analysis Program (FRAP) code and has been applied to a pressurized water reactor (PWR) fuel rod undergoing a loss-of-coolant accident (LOCA). The method of uncertainty analysis is the response surface method. The automated version significantly reduced the time required to complete the analysis and, at the same time, greatly increased the problem scope. Results of the analysis showed a significant difference in the total and relative contributions to the uncertainty of the response parameters between steady state and transient conditions.

8266 (CONF-781022—14) **Influence of steam generator tube ruptures during semiscale loss-of-coolant experiments.** Cozzuol, J.M.; Larson, T.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 11p. Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

Examination of the U-tubes in the steam generators of some large commercial pressurized water reactors (PWR) has revealed the existence of leakage and in some cases structural weakening of the tubes. This structural weakening enhances the possibility of tubes rupturing during a hypothesized loss-of-coolant accident (LOCA). Considerable interest has been shown in the analysis of tube ruptures concurrent with a hypothesized LOCA since the presence of tube ruptures has the potential to influence the system thermal-hydraulic response and could foreseeably result in a more severe core thermal behavior than might otherwise occur. To experimentally investigate the influence of steam generator tube ruptures on the thermal-hydraulic response of PWR type system, a series of experiments was conducted in the Semiscale Mod-1 system by EG and G Idaho, Inc., for the U.S. Nuclear Regulatory Commission and the Department of Energy. The primary objective of the experiments was to obtain data which could be used to evaluate the influence of the simulated tube ruptures on the system and core thermal-hydraulic response for a range of tube ruptures that was expected to provide the potential for high cladding temperatures in the Semiscale facility. The experiments were conducted assuming a variety in the number of tubes ruptured during large break loss-of-coolant conditions. The number of experiments conducted permitted determination of the range of tube ruptures for which high peak cladding temperatures could result in the Semiscale Mod-1 system. The paper contains a description of the Semiscale Mod-1 system and a discussion of the steam generator tube rupture tests conducted. The experimental results from the test series and the thermal-hydraulic phenomena found to influence the core thermal response during the experiments are discussed.

8267 (CONF-781022—17) **Analysis of a simulated small break in the semiscale system under loss-of-coolant accident conditions.** Cartmill, C.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 12p. Dep. NTIS, PC A02/MF A01.

From Meeting on nuclear power reactor safety; Brussels, Belgium (16 Oct 1978).

The Semiscale Mod-1 experimental program conducted by EG and G Idaho, Inc., is part of the overall U.S. Nuclear Regulatory Commission (NRC) and Department of Energy (DOE) sponsored research and development program to investigate the behavior of the pressurized water reactor (PWR) system during an hypothesized loss-of-coolant accident (LOCA). The Semiscale Mod-1 program is intended to provide transient thermal-hydraulic data from a simulated LOCA using a small-scale experimental nonnuclear system. The Semiscale Mod-1 program is a major contributor of experimental data that provide a means of evaluating the adequacy of overall system analytical models as well as the models of the individual system components. Selected experimental data produced by this program will also be used to aid other DOE and NRC sponsored experimental programs, such as the Loss-of-Fluid Test (LOFT) program in optimizing test series, selecting test parameters, and evaluating test results. The Semiscale Mod-1 tests are performed with an experimental system which simulates the principal features of a nuclear plant but which is smaller in volume. Nuclear heating is simulated in the tests by a core composed of an array of electrically heated rods. The core is contained in a pressure vessel which also includes a downcomer, lower plenum, and upper plenum. The Semiscale system piping is arranged such that the intact loop represents three loops of a four-loop nuclear plant, and the broken loop represents the fourth loop. In the present configuration the intact loop contains an active steam generator and pump, and the broken loop contains passive simulators for the steam generator and pump.

8268 (CONF-781105—5) **Calculations of flow oscillations during reflood using RELAP4/MOD6.** Chen, Y.S.; Sulivan, L.H. (Idaho National Engineering Lab., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 6p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Flow oscillations between the downcomer and the electrically heated core during reflood have been observed in reflood experimental facilities such as Semiscale and FLECHT-SET (Westinghouse). The purpose of the study described was to investigate the primary mechanism responsible for the initiation and continuation of the oscillations during reflood using the RELAP4/MOD6 code. The study produced significant results concerning the accuracy of RELAP in predicting the dynamic features of density-wave and pressure drop oscillations, and was conducted on the German three-loop PRIMAR KREISLAUF (PLK) Reflood Experimental System. RELAP4/MOD6 is an analytical computer code which can be used for best estimate analysis of PWR or BWR reactor system blowdown and reflood response to a postulated LOCA.

8269 (CONF-781105—8) **Improved method for conducting failed fuel experiments in LWR's.** Thomas, R.W.; Klingler, W.B. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 5p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

In conduct of the Sodium Loop Safety Facility (SLSF) experiment program in the Engineering Test Reactor (ETR), destructive tests are performed with up to 37 full length (0.914m fuel zone) LMFBR type fuel pins in a sodium environment. Operation of such experiments in a light water reactor like the ETR requires careful attention to safety. A major problem is how to run destructive experiment transients of sufficient duration to satisfy sponsors needs without jeopardizing the reactor. The paper discusses the way

in which EG and G has minimized the difference between nominal and design basis transients, thereby allowing destructive tests of maximum safe duration.

8270 (CONF-781105—19) **Similarities and differences in vapor explosion criteria.** Cronenberg, A.W. (Idaho National Engineering Lab., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 5p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

An overview of recent ideas pertaining to vapor explosion criteria indicates that in general sense, a consensus of opinion is emerging on the conditions applicable to explosive vaporization. Experimental and theoretical work has lead a number of investigators to the formulation of such conditions which are quite similar in many respects, although the quantitative details of the model formulation of such conditions are somewhat different. All model concepts are consistent in that an initial period of stable film boiling, separating molten fuel from coolant, is considered necessary (at least for large-scale interactions and efficient intermixing), with subsequent breakdown of film boiling due to pressure and/or thermal effects, followed by intimate fuel-coolant contact and a rapid vaporization process which is sufficient to cause shock pressurization. Although differences arise as to the conditions for and the energetics associated with film boiling destabilization and the mode and energetics of fragmentation and intermixing. However, the principal area of difference seems to be the question of what constitutes the requisite condition(s) for rapid vapor production to cause shock pressurization.

8271 (CONF-781105—20) **Freezing and melting phenomena in finite-media, with application to molten fuel containment for SLSF experiments.** El-Genk, M.S.; Cronenberg, A.W.; Moore, R.L. (New Mexico Univ., Albuquerque (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 12p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The Sodium Loop Safety Facility (SLSF) experiments are being conducted to furnish information concerning the behavior of fast reactor fuel elements under postulated off-normal or hypothesized loss-of-flow accident conditions. Such experiments involve measurements and observations that will permit an assessment of the location and time of sodium void initiation, the nature of sodium explusion and reentry, the time and nature of cladding failure and motion, the nature of molten fuel motion, and the extent of plugging at the axial extremities of the subassembly. Because such high energy experiments are to be conducted in-pile within the Experimental Test Reactor (ETR) Facility, extensive pretest analysis is required to insure loop integrity. One aspect of this problem is an assessment of molten fuel freezing phenomena on the walls of SLSF to insure the containment capability of the loop, which is the subject of the paper.

8272 (CONF-781105—27) **Rod thermal response during isothermal loss-of-coolant experiments.** Peterson, A.C.; Winters, L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 4p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The thermal response of a PWR core to a blowdown from isothermal conditions was investigated in the Loss-of-Fluid Test (LOFT) facility as part of a series of isothermal tests. The analysis of the core thermal response during this investigation and comparison of the test results with Semiscale counterpart test results and RELAP4/MOD6 calculations provide additional insight into the thermal-hydraulic phenomena occurring during a loss-of-coolant experiment (LOCE).

8273 (CONF-781105—34) **Effect of reflood prediction uncertainties on LOFT cladding oxidation.** Niebruegge, D.A.; Tolman, E.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1978. Contract EY-76-C-07-1570. 5p. Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The FLOOD4 and RELAP4/MOD6 computer codes, which are used to perform LOFT reflood analysis, have been compared to FLECHT-SET and Semiscale gravity feed tests to provide an evaluation of core reflood prediction techniques and an identification of phenomena important to LOFT reflood behavior. These comparisons provide a basis for estimating uncertainty in cladding temperature history during the LOFT loss-of-coolant experiments (LOCEs). The bounds on the cladding temperature response are then utilized to estimate a range of expected cladding oxidation and embrittlement which is essential for identifying special equipment needed during replacement, storage, and post-test examination of LOFT fuel modules. FLOOD4 couples the system hydraulic response with core heat transfer and steam generation. Four heat transfer correlations simulate the boiling curve and liquid entrainment, fallback and vaporization in the steam generators are modeled. FLOOD4 requires user input multipliers to specify the dispersed flow heat transfer, liquid entrainment and correlations to describe liquid fallback from the upper plenum region. The fraction of liquid vaporized in the steam generators must also be user input.

8274 **Modal superposition method for computationally economical nonlinear structural analysis.** Shah, V.N.; Bohm, G.J.; Nahavandi, A.N. (Westinghouse Electr Corp, Pittsburgh, Pa). *Am. Soc. Mech. Eng., [Pap.]*; No. 78-PVP-70, 1-9(1978).

A modal superposition method for analyzing nonlinear structural dynamics problems involving impact between components is developed and evaluated. The finite element method is used to express the equations of motion with nonlinearities represented by pseudo force vector. Three test problems are solved to verify this method. This has demonstrated the applicability of this method to seismic analysis of large, complex structureal systems. It is concluded that the modal superposition method has a significant cost advantage over the direct integration method for problems with large wave fronts and the source of non-linearities restricted to a limited portion of the structure. 18 refs.

8275 (GA-A—14087) **One-fifth-scale and one-half-scale two-dimensional seismic tests.** Peterson, D.; Olsen, B.E. (General Atomic Co., San Diego, CA (USA)). Jun 1978. Contract EY-76-C-03-0167-065. 158p. Dep. NTIS, PC A08/MF A01.

Uni-axial seismic tests were performed on $^1/_5$-scale and $^1/_2$-scale two-dimensional models of the HTGR core consisting of 73 graphite elements in a hexagonal array. Core displacement and velocity, boundary support force, and in-core element force were measured. The test rigs were excited in two directions: across-the-flats of an element and across-the-corners. Results from the two models were compared on a normalized scale basis to check the scaling laws.

8276 (GA-A—14700) **Flow-induced vibrations in the 300-MW(e) gas-cooled fast breeder reactor demonstration plant: a scoping study.** Halvers, L.J. (General Atomic Co., San Diego, CA (USA)). Aug 1978. Contract EY-76-C-03-0167-023. 75p. Dep. NTIS, PC A04/MF A01.

The susceptibility of the primary coolant boundary components of the 300-MW(e) gas-cooled fast breeder reactor (GCFR) demonstration plant to flow-induced vibrations is analyzed. This preliminary analysis is based on the 1974 reference design. Many design changes have been proposed, but this report examines only the instrument tree design. This study shows that the analytical models developed so far can be used only for the most simple systems, and they have a very limited value for the often complicated primary coolant boundary components. The highly turbulent flow field further complicates the analysis. The results, however, provide an understanding of the basic parameters and some insight into the most vulnerable components as well as ways and means to avoid problem areas. Some general guidelines which can be used in the early stages of the design to avoid or minimize the probability of flow-induced vibrations are presented. It is recommended that the assembly locking mechanisms be eliminated and other means of locking the assemblies to the grid plate be used. These should be less susceptible to flow-induced vibrations. The number of radial support plates for the steam generators should be increased from 4 to 6 to avoid whirling.

8277 (LA—7278-PR) **Nuclear reactor safety. Quarterly progress report, 1 January—31 March 1978.** Jackson, J.F.; Stevenson, M.G. (comps.). (Los Alamos Scientific Lab., NM (USA)). Jun 1978. Contract W-7405-ENG-36. 134p. (NUREG/CR—0062). Dep. NTIS, PC A07/MF A01.

A major milestone was reached in the LWR safety program with the completion of a continuous TRAC calcualtion of an entire LOCA accident sequence (blowdown, refill, and reflood) in a full-size PWR reactor model. An initial study of the lower plenum flow patterns in one of the proposed designs for the Japanese slab core reflood experiment was performed with the SAM code. A noncondensible gas field was added to the K-TIF code. Several improvements were made to the SIMMER LMFBR accident analysis code. Progress was made in the performance and analysis of the multicomponent condensation experiment, the air-particle drag tests, and the flow coastdown experiment. In the HTGR safety research program, modifications to the fuel particle heat-up apparatus were completed and testing was resumed. Results from the new elastic-plastic oncrete model in NONSAP-C were compared to results from the previous variable modulus-cracking model, and the newer model appears more technically correct. Work continued in the development of the CHAP-2 code for transient analysis of the Ft. St. Vran HTGR, and a workshop on the use of the CHAP codes and the general systems analysis code LASAN was held at Los Alamos. Planning, design, and fabrication continued for the GCFR out-of-pile experimental program. Assembly and instrumentation were completed for the first full-length 37-rod experimental package for use in the first DMFT. In the containment analysis and evaluation area, improvements were made to the COMPARE subcompartment analysis code, progress was made on a sensitivity study of key

parameters in subcompartment analyses, and an initial correlation was developed to describe natural convection condensation heat transfer within containment structures.

8278 (LTR—1310-26) **PSMG sets A and B protective relaying.** Burnett, J.E. (Idaho National Engineering Lab., Idaho Falls (USA)). 24 Jul 1978. Contract EY-76-C-07-1570. 15p. Dep. NTIS, PC A02/MF A01.

The "TAN/LOFT 13.8 kV, 2.4 kV, and 480 V Relay and Circuit Breaker Coordination Study" presented an analysis to determine overcurrent settings for the LOFT Power System protective relays including those for the drive motors of the PSMG sets. This LTR is written to form the basis of the relay settings entered in Specification ES-60238 Rev. B, for protection of the PSMG generator, primary coolant pump motor and interconnecting power cable. A momentary commercial power voltage dip occurred on January 10, 1978 which caused a trip of the PSMG field breakers. A corrective design to prevent reoccurrence is discussed and recommendations are presented.

8279 (NUREG/CP—0004(Vol.2), pp 563-574) **Short time decay of irradiated fuel.** Baumung, K. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

In the last few years the discussion about the loss of flow accident has stimulated a number of new activities in the field of decay power determination. Special emphasis was given to short cooling times, i.e., the first thousand seconds after shutdown. This paper gives a survey of the methods used in short time decay power determination and reports the state of the art in summation calculations and decay power measurements. Fission product decay heat curves are given for several irradiation times.

8280 (NUREG/CR—0105) **PWR Blowdown Heat Transfer Separate-Effects Program data evaluation report: heat transfer for THTF test series 100.** Craddick, W.G.; Hyman, C.R.; Hedrick, R.A.; Mullins, C.B.; Turnage, K.G. (Oak Ridge National Lab., TN (USA)). 31 Aug 1978. Contract W-7405-ENG-26. 258p. (ORNL/NUREG—45). Dep. NTIS, PC A12/MF A01.

Heat transfer phenomena are analyzed for test series 100 of the Thermal-Hydraulic Test Facility, part of the Pressurized-Water Reactor Blowdown Heat Transfer Separate-Effects Program. Heater rod surface temperatures are found to be sensitive to relatively small variations in flow. The mechanisms causing departure from nucleate boiling and rewetting are analyzed. Comparisons are made between heater rod surface temperatures calculated from thermocouple responses and surface temperatures produced by the thermal-hydraulic transient simulator RELAP4/MOD5 (update 2). The code's predictions are relatively accurate in the lower region of the test section and considerably high in the upper region. The procedures in the code which produce these results are discussed in detail.

8281 (NUREG/CR—0117) **LMFBR aerosol release and transport Program quarterly progress report, January—March 1978.** Kress, T.S. (Oak Ridge National Lab., TN (USA)). 25 Aug 1978. Contract W-7405-ENG-26. 62p. (ORNL/NUREG/TM—213). Dep. NTIS, PC A04/MF A01.

Progress is summarized in studies designed to investigate radionuclide release and transport from LMFBRs for reactor events of severity up to and including hypothetical core-disruptive accidents (HCDAs). Experimental program topics discussed include: recent Capacitor Discharge Vaporization tests in the CRI-III facility at its new FAST site; FAST facility installation progress; performance tests for the consumable electrode aerosol generator in NSPP and the U_3O_8 aerosol behavioral results accompanying the performance tests; development of a back-up "flame-spray" U_3O_8 aerosol generator for high densities; and progress in making a trial HCDA source term analysis.

8282 (NUREG/CR—0120) **Effect of energy density on aerosol yield and primary particle sizes produced by the capacitor discharge vaporization (CDV) of UO_2.** Wright, A.L.; Bertini, H.W.; Kress, T.S.; Tobias, M.L.; Kelly, M.J.; Parsly, L.F.; White, J.S. (Oak Ridge National Lab., TN (USA)). 31 Aug 1978. Contract W-7405-ENG-26. 54p. (ORNL/NUREG/TM—163). Dep. NTIS, PC A04/MF A01.

The report documents experimental results obtained in the CRI-III/CDV portion of the ORNL Aerosol Release and Transport (ART) Program, sponsored by the Advanced Reactor Safety Research Division of the Nuclear Regulatory Commission. In the CRI-III/CDV program, the capacitor discharge vaporization (CDV) technique is used to bring simulant LMFBR fuel samples (UO_2) to energy states representative of those calculated for severe hypothetical core-disruptive accidents (HCDAs). The high-energy molten UO_2 undergoes a free expansion in the CRI-III vessel, and the vapor produced converts to an aerosol. The report discusses the results of tests where the major objective was to establish the UO_2 aerosol mass made airborne (yield) and the size distribution of the primary aerosol as a function of the energy content of the UO_2 before expansion.

8283 (NUREG/CR—0304) **Mixing of radiolytic hydrogen generated within a containment compartment following a LOCA.** Willcutt, G.J.E. Jr.; Gido, R.G. (Los Alamos Scientific Lab., NM (USA)). Jul 1978. Contract W-7405-ENG-36. 61p. (LA—7421-MS). Dep. NTIS, PC A04/MF A01.

The objective of this work was to determine hydrogen concentration variations with position and time in a closed containment compartment with radiolytic hydrogen generation in the water on the compartment floor following a Loss-of-Coolant-Accident (LOCA). One application is to determine the potential difference between the compartment maximum hydrogen concentration and a hydrogen detector reading, due to the detector location. Three possible mechanisms for hydrogen transport in the compartment were investigated: (1) molecular diffusion, (2) possible bubble formation and motion, and (3) natural convection flows. A base case cubic compartment with 6.55-m (21.5-ft) height was analyzed. Parameter studies were used to determine the sensitivity of results to compartment size, hydrogen generation rates, diffusion coefficients, and the temperature difference between the floor and the ceiling and walls of the compartment. Diffusion modeling indicates that if no other mixing mechanism is present for the base case, the maximum hydrogen volume percent (vol percent) concentration difference between the compartment floor and ceiling will be 4.8 percent. It will be 24.5 days before the maximum concentration difference is less than 0.5 percent. Bubbles do not appear to be a potential source of hydrogen pocketing in a containment compartment. Compartment natural convection circulation rates for a 2.8 K (5°F) temperature difference between the floor and the ceiling and walls are estimated to be at least the equivalent of 1 compartment volume per hour and probably in the range of 4 to 9 compartment volumes per hour. Related natural convection studies indicate there will be turbulent mixing in the compartment for a 2.8 K (5°F) temperature difference between the floor and the ceiling and walls.

8284 (NUREG/CR—0339) **LMFBR safety. 6. Review of current issues and bibliography of literature (1977).** Buchanan, J.R.; Keilholtz, G.W. (Oak Ridge National Lab., TN (USA)). 13 Jul 1978. Contract W-7405-ENG-26. 105p. (ORNL/NUREG/NSIC—151). Dep. NTIS, PC A06/MF A01.

This report discusses the current status of liquid-metal fast breeder reactor (LMFBR) development. Selected bibliographic information on LMFBRs relative to the development and safety of the breeder reactor is presented for the year 1977. The bibliography consists of approximately 198 abstracts covering research and development, operating experience, and design practices. Keyword, author, and permuted-title indexes are included for completeness.

8285 (NUREG/CR—0367) **Prompt burst energetics experiments: fresh oxide/sodium series.** Reil, K.O.; Young, M.F. (Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EY-77-C-01-0789. 83p. (SAND—78-1561). Dep. NTIS, PC A05/MF A01.

A series of in-pile experiments has been performed to provide information on thermal energy to work conversion under prompt burst excursion (PBE) conditions. These consisted of single pin tests using fresh uranium oxide or uranium carbide fuel in a capsule geometry, with either stagnant sodium or helium in the coolant channel. The experiments were irradiated with single or double pulses in the Annular Core Pulse Reactor (ACPR) to provide energy depositions up to 2900 J/g. This report covers the seven single and five double pulse UO_2 sodium-in tests. Experimental data includes pressure and linear motion transducer histories, measured work-energy conversion efficiencies, and post-irradiation examination. Analysis includes derived work-energy conversion efficiencies (up to 0.54%), pin failure modeling, hydrodynamic analysis of pressure pulse propagation in the channel, and piston stopping effects. Initial pressure events in the single pulse experiments appear to be dominated by fuel vapor pressure. Definite fuel-coolant interactions were observed in several experiments, including some that were coincident with stopping of the linear motion transducer piston, suggesting a possible triggering effect by the deceleration pressure.

8286 (PNL—2633) **Review of methodology for accident consequence assessment.** Strenge, D.L.; Soldat, J.K.; Watson, E.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1978. Contract EY-76-C-06-1830. 73p. Dep. NTIS, PC A04/MF A01.

This report reviews current methodologies for reactor accident consequence analysis and describes areas where modifications are warranted. Methodologies reviewed are: (1) Models in Regulatory Guides 1.109, 1.111 and 1.113 used for evaluation of compliance with 10 CFR 50 Appendix I; (2) Models in Regulatory Guides used for evaluation of consequences from accidents of Classes 3-8; (3) Models for evaluation of Class 9 accidents presented in the Reactor

Safety Study; and (4) Models in the Liquid Pathway Generic Study. The review is designed to aid in the ultimate goal of selection of a comprehensive set of models to extend the Class 9 methodology of the Reactor Safety Study to the analysis of Classes 3-8 accidents.

8287 (SAND—78-1251C) **Interpretation of debris bed dryout observed during the D-3 experiment.** Rivard, J.B. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 5p. (CONF-781105—39). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

In the D-3 experiment, a nominally 158 mm-deep particle bed was formed by 7.29 kg of UO_2. The sodium volume fraction within the bed was 0.43. Runs were performed at bulk sodium temperatures of 773, 673, and 873 K. Dryout (liquid voidage by vapor blanketing) of a shallow zone at the bottom of the bed occurred when the power was increased in the already-boiling and convecting bed at 773 and 673 K. Temperature limitations on the experiment prevented the attainment of dryout at 873 K. Measurements and analysis of dryout observed during the D-3 experiment show: (1) the observed temperature transients during dryout can be explained in terms of a conduction process in an expanding zone; (2) the expansion is a displacement process; (3) expansion of the zone reduces the height of the overlying convection zone; and (4) while bed dryout may be a necessary condition for remelting of the fuel to occur, it may not always be a sufficient condition.

8288 (SAND—78-1336C) **Time-resolved penetration measurements of liquid sodium into limestone concrete.** Smaardyk, J.E.; Sutherland, H.J.; Kent, L.A. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 9p. (CONF-781105—26). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The treatment of post-accident containment problems for advanced reactors requires an understanding of how the structural concrete beneath the reactor vessel behaves when subjected to molten reactor plant materials. Of special interest is the case of a sodium spill because the resulting chemical reactions are exothermic and generate considerable quantities of gas. An important parameter in these reactions is the rate at which the reaction zone penetrates the concrete.

8289 (SAND—78-1343C) **Turbine-missile casing exit tests.** Yoshimura, H.R.; Sliter, G.E. (Sandia Labs., Albuquerque, NM (USA); Electric Power Research Inst., Palo Alto, CA (USA)). 1978. Contract EY-76-C-04-0789. 5p. (CONF-781105—36). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Nuclear power plant designers are required to provide safety-related components with adequate protection against hypothetical turbine-missile impacts. In plants with a "peninsula" arrangement, protection is provided by installing the turbine axis radially from the reactor building, so that potential missile trajectories are not in line with the plant. In plants with a "non-peninsula" arrangement (turbine axis perpendicular to a radius), designers rely on the low probability of a missile strike and on the protection provided by reinforced concrete walls in order to demonstrate an adequate level of protection USNRC Regulatory Guide 1.115). One of the critical first steps in demonstrating adequacy is the determination of the energy and spin of the turbine segments as they exit the turbine casing. The spin increases the probability that a subsequent impact with a protective barrier will be off-normal and therefore less severe than the normal impact assumed in plant designs. Two full-scale turbine-missile casing exit tests which were conducted by Sandia Laboratories at their rocket-sled facility in Albuquerque, New Mexico, are described. Because of wide variations in turbine design details, postulated failure conditions, and missile exit scenarios, the conditions for the two tests were carefully selected to be as prototypical as possible, while still maintaining the well-controlled and well-characterized test conditions needed for generating benchmark data.

8290 (UNI-SA—48) **Impact of sophisticated fog spray models on accident analyses.** Roblyer, S.P.; Owzarski, P.C. (United Nuclear Industries, Inc., Richland, WA (USA); Sigma Research, Inc., Richland, WA (USA)). 12 Jul 1978. Contract EY-76-C-06-1857. 19p. (CONF-780819—6). Dep. NTIS, PC A02/MF A01.

From 15. nuclear air cleaning conference; Boston, MA, USA (Aug 1978).

The N-Reactor confinement system release dose to the public in a postulated accident is reduced by washing the confinement atmosphere with fog sprays. This allows a low pressure release of confinement atmosphere containing fission products through filters and out an elevated stack. The current accident analysis required revision of the CORRAL code and other codes such as CONTEMPT to properly model the N Reactor confinement into a system of multiple fog-sprayed compartments. In revising these codes, more sophisticated models for the fog sprays and iodine plateout were incorporated to remove some of the conservatism of steam condensing rate, fission product washout and iodine plateout than used in previous studies. The CORRAL code, which was used to describe the transport and deposition of airborne fission products in LWR containment systems for the Rasmussen Study, was revised to describe fog spray removal of molecular iodine (I_2) and particulates in multiple compartments for sprays having individual characteristics of on-off times, flow rates, fall heights, and drop sizes in changing containment atmospheres. During postulated accidents, the code determined the fission product removal rates internally rather than from input decontamination factors. A discussion is given of how the calculated plateout and washout rates vary with time throughout the analysis. The results of the accident analyses indicated that more credit could be given to fission product washout and plateout. An important finding was that the release of fission products to the atmosphere and adsorption of fission products on the filters were significantly lower than previous studies had indicated.

8291 **Sensitivity of peak cladding temperatures to loss-of-coolant accident reflood parameters.** Oehlberg, R.N.; Scott, H.H. (Nuclear Regulatory Commission, Washington, DC). *Nucl. Technol.;* **40**: No. 3, 248-260(Oct 1978).

A partitioning of a hypothetical pressurized water reactor loss-of-coolant accident time history into pre-reflood and reflood periods allowed a study of reflood parameter effects without a well-defined knowledge of the complex blowdown history. Values for the initial reflood fuel rod temperature profiles, reflood cladding-to-coolant heat transfer coefficient (HTC), decay heat, and initial reflood hot node hoop strain were chosen to parametrically describe the initial reflood condition of the fuel rod. The sensitivity of the reflood peak cladding temperature to decay heat was constant; the sensitivity to the gap conductance was only a function of the initial reflood hoop strain. The sensitivity to decay heat and the reflood HTC ramp was greater for the lower initial reflood centerline temperature case.

8292 **Effects of nozzle-to-target distance on wastage in small-leak sodium-water reactions.** Kanegae, N.; Hashiguchi, K.; Ikemoto, I.; Hori, M. (Power Reactor and Nuclear Fuel Development Corp., Ibaraki, Japan). *Nucl. Technol.;* **40**: No. 3, 261-277(Oct 1978).

The wastage effects of a sodium-water reaction resulting from a small leak in a liquid-metal fast breeder reactor steam generator were investigated. These experiments were conducted at low steam injection rates, ranging from 0.07 to 13.8 g/s, with the following test conditions: sodium temperature 480°C, sodium velocity 0.24 m/s, and target material $2\frac{1}{4}$ Cr—1 Mo steel. Employed were nozzle diameters (D) from 0.2 to 1.5 mm, nozzle-to-target distances (L) from 5 to 100 mm, and L/D ratios from 7.14 to 400. An empirical equation of wastage rate of $2\frac{1}{4}$ Cr—1 Mo steel was obtained, including parameters of sodium temperature, steam injection rate, and nozzle-to-target distance. The depth curves and the widths of the area affected by wastage were examined. These test results were applied to the safety considerations for the prototype steam generators in Japan.

8293 **Investigation of activity release during light water reactor core meltdown.** Albrecht, H.; Matschoss, V.; Wild, H. (Kernforschungszentrum, Karlsruhe, Ger.). *Nucl. Technol.;* **40**: No. 3, 278-283(Oct 1978).

A test facility was developed for the determination of activity release and of aerosol characteristics under realistic light water reactor core melting conditions. It is composed of a high-frequency induction furnace, a ThO_2 crucible system, and a collection apparatus consisting of membrane and particulate filters. Thirty-gram samples of a representative core material mixture (corium) were melted under air, argon, or steam at 0.8 to 2.2 bar. In air at 2700°C, for example, the relative release was 0.4 to 0.7% for iron, chromium, and cobalt and 4 to 11% for tin, antimony, and manganese. Higher release values of 20 to 40% at lower temperatures (2150°C, air) were found for selenium, cadmium, tellurium, and cesium. The size distribution of the aerosol particles was trimodal with maxima at diameters of 0.17, 0.30, and 0.73 μm. The result of a qualitative x-ray microanalysis was that the main elements of the melt were contained in each aerosol particle. Further investigations will include larger melt masses and the additional influence of concrete on the release and aerosol behavior.

8294 **Temperature measurement of ratio pyrometers of melting pool surfaces.** Mack, A. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). *Nucl. Technol.;* **40**: No. 3, 341-347(Oct 1978).

The errors in measurement employing quotient pyrometry are a function of the temperature and the effective wavelengths used. They are generated by the spectral emission coefficients of the surface of the test specimen and the spectral transmissivity of the media in the beam path. Temperature-independent deviations up to -30°K have been found for various imaging lenses using calibrated tungsten strip lamps. The influence of metal vapors over the melt was determined by spectral photometric measurements over the surface of the melting charge. No selective behavior was found for cadmium, tin, indium, nickel, chromium, iron, titanium, manganese,

silicon, and stainless steel (material No. 1.4550). Measurements of the freezing points of silicon, iron, manganese, nickel, and chromium were carried out to determine the influence of the spectral emission coefficients of the surfaces of the melting charges. The ratios of the emission coefficients for wavelengths of 500 and 580 nm were below unity for all these metals, i.e., the temperature values indicated were above the actual freezing points. Measurements on corium melts (55% steel, 35% UO_2, 10% Zircaloy-2) under an oxidizing atmosphere were greatly influenced by bubbles on the surface of the melting charge and by burning phenomena of ejected particles. The error brought about by the spectral emission coefficient of the corium surface cannot be indicated.

8295 Transient pressurization and transport of a two-component gas within interconnected porosity of solid mixed-oxide fuel. Hofmann, J.R. (Argonne National Lab., IL). *Nucl. Sci. Eng.;* **68**: No. 1, 73-90(Oct 1978).

A model has been developed to describe the transient pressure field within the interconnected porosity of solid mixed-oxide fast reactor fuel during a reactor transient. The pore gas may be composed of up to two distinct chemical species, so that gas released from fuel grains may differ chemically from the fill gas originally present within the porosity of the fuel. The volume expansion of fuel upon melting is accounted for, but mechanical deformation of the solid fuel is not modeled. Results are presented for a hypothetical unprotected transient overpower accident in a gas-cooled fast reactor with ramp rates of 0.10, 1.0, and 10.0 dollar/s. In these calculations, fuel cladding failure is computed from a linear accumulative damage law and a Larson-Miller parameter correlation.

8296 Self-initialization of the RELAP4 code momentum equation. Kern, R.C. (Nuclear Associates International Corp., Rockville, MD.); Hsu, M.T. *Nucl. Sci. Eng.;* **68**: No. 1, 141-143(Oct 1978).

One difficulty in using the RELAP4 code is that, owing to the overspecification of the volume and junction input data for the initial conditions, a residual friction term must be defined to establish steady-state conditions. If the corresponding residual friction coefficient is out of allowable range, the calculation is terminated at the initial data checking phase. An allowable residual friction coefficient is added to the form loss coefficient and is used throughout the transient calculation. This might affect the results if the residual friction coefficient is large. However, to model a system represented by a large number of volumes and junctions, manual adjustment of the input data, such as the pressure distribution, to reduce the effect of residual terms can take a significant amount of engineering time. A procedure that allows the code to do the adjustment internally is described.

8297 Numerical simulation of hydrodynamic impact loads on cylinders. Nichols, B.D.; Hirt, C.W. (Los Alamos Scientific Lab., NM). *Nucl. Sci. Eng.;* **68**: No. 1, 143-148(Oct 1978).

A simple numerical solution algorithm is used to model rigid body impacts on liquid surfaces. Computed fluid impact loads on right circular cylinders are in excellent agreement with experimental data. Several calculations are performed with varying fluid sheet thicknesses, impact velocities, and cylinder diameters. These calculations verify the scaling ability of the theoretical model and provide insight into how loading histories vary with the configuration of the impacting fluid.

8298 Publication concerning the draft of a technical safety guideline for nuclear power plants (Safety Guide) of the International Atomic Energy Agency. Dated May 8th, 1978. *Bundesanzeiger;* **30**: No. 90, 3(May 1978). (In German).

The publication deals with amendments to the 'Safety Guide on Protection Systems and Related Features in Nuclear Power Plants (SG - D3)'.

8299 Effects of countercurrent single and two-phase flows on the quenching rate of hot surfaces. Duffey, R.B.; Ackerman, M.C.; Piggott, B.D.G.; Fairbairn, S.A. (CEGB, Berkeley Nucl Lab, Gloucestershire, Engl). *Int. J. Multiphase Flow;* **4**: No. 2, 117-140(May 1978).

A theoretical and experimental study of liquid film flow and quench front propagation on hot vertical surfaces in the presence of single and two-phase upflows is reported. Experiments in which a water jet was used to cool a single rod set in a transparent tube showed that the downward progress of a quenched front was significantly retarded or even stopped by an air or steam upflow. Climbing quench fronts were observed which sometimes coexisted with the falling quench fronts, but at surface temperatures above 900°C and flow rates below 0.9 g/s/cm both quench fronts became stationary. Conventional flooding correlations have been shown to overestimate the upflow necessary to cause flow reversal particularly at high surface temperatures. 52 refs.

8300 Nuclear energy and risk - experts meeting in November 1977 in Munich. Danzmann, H.J. *Schweissen Schneiden;* **30**: No. 2, 76-78(Feb 1978). (In German).

As nuclear energy in public discussion is assessed not only by its benefit for the national economy, but above all by its risk, the interest in the subject was demonstrated by experts and public alike. The central point of the meeting was the German reactor safety study, apostrophized as 'Birkmussen Report', as in this report - under the leadership of A. Birkhofer - the applicability of the results of the American reactor safety study WASH-1400, the 'Rasmussen Report' (the final version of which appeared two years ago) on German conditions is investigated.

8301 Sensitivity analysis of the effectiveness of PWR reactor protection systems. Nikodem, H.J. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). pp 355-358 of Reaktortagung Hannover, 4.4.-7.4.1978. Sektion 2: Sicherheit kerntechnischer Anlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

In imitation of the methods employed in the US reactor safety study WASH-1400, it was estimated to what extent the probability of radioactivity release into the atmosphere can be reduced by using or improving the following safety systems: Burst protection of the reactor pressure vessel and the whole primary system; containment spray system; emergency cooling system; safety isolating elements.

8302 Fluid-structural-dynamic calculation of the pressure relief processes in the annular space of pressure vessels during blowdown. Rott, W. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). pp 218-221 of Reaktortagung, Hannover. Sektion 2. Sicherheit kerntechnischer Anlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

8303 Results and evaluation of blowdown experiments in a model containment with a number of compartments. Schall, M.; Kanzleiter, T.; Sparwel, N. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). pp 343-346 of Reaktortagung, Hannover. Sektion 2. Sicherheit kerntechnischer Anlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

8304 Determining pressure build-up in THTR-300 plant compartments after primary pipe breaks using the DANZ computer code. Becker, E.; Kasparek, G.; Welhusen, B. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)); Kuttruf, H. (Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)). pp 335-338 of Reaktortagung, Hannover. Sektion 2. Sicherheit kerntechnischer Anlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

One of the essential aims on analyzing depressurization accidents is the determination of the escape rate and the associated enthalpy. With these parameters for a given room configuration the accident pressure for the individual compartments may be calculated. In order to cope with both problems the multi-zone code DANZ was developed computing pressure and temperature behavior for arbitrarily coupled room configurations and a two-component gas flow.

8305 Influence of accidents with water ingress on the behaviour of THTR-300 fuel elements. Kubaschewski, P.; Heinrich, B. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.); Hochtemperatur-Reaktorbau G.m.b.H., Juelich (Germany, F.R.)). pp 331-334 of Reaktortagung, Hannover. Sektion 2. Sicherheit kerntechnischer Anlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). (In German)

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

For a high-temperature reactor with dual-loop system the steam generator tube rupture accident is of great importance for the safety considerations. The subject paper gives a picture of the extent of fuel damaged by water ingress if, at the same time and independent of this event, additionally an active component of the reactor plant fails.

8306 Comparative analysis of a hypothetical loss of flow accident in a LMFBR using different computer models for a common benchmark problem. Royl, P.; Maschek, W.; Struwe, D. (Kernforschungszentrum Karlsruhe (Germany, F.R.)); Billington, D.; Perks,

M. (UKAEA Reactor Group, Risley); Evrard, A.; Renard, A. (Societe Belge pour l'Industrie Nucleaire, Brussels); DeFremont, R.; DeLapparent, D.; Penet, F. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). pp 298-302 of Reaktortagung, Hannover. Sektion 2. Sicherheit kerntechnischer Anlagen. Eggenstein-Leopoldshafen, Germany, F.R.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978).

From Reactor congress; Hannover, F.R. Germany (4 Apr 1978).

The comparative loss of flow accident analysis has provided a deeper understanding about possibilities and limits of the different applied approaches to accident analysis. The outlined differences could be explained by more detailed model comparisons. Although the degree of sophistication in modeling was considerably different all codes lead to a reasonably good agreement in integral results such as the molten fuel energy.

8307 Dynamic pressure loads on liquid-filled shells. Mayr, M. (Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl A fuer Mechanik); Schweiger, W. (PSP Ingenieurplanung, Puchheim (Germany, F.R.)). *Forsch. Ingenieurwes.;* **44**: No. 2, 37-68(1978). (In German).

The fluid structure coupling model is solved with the aid of boundary value integral equations. This method of solution is explained using a simplified model of a pressure relief system of a nuclear reactor. The main calculation results for this model are given.

8308 Application of light foam for removal of sodium oxide particles from exhaust of sodium fires. Menzenhauer, P.; Farrenkopf, D. *VFDB (Ver. Foerder. Dtsch. Brandschutzes) Z.;* No. 1, 29-33(1978). (In German).

The outstanding factors cover experimental tests to extract sodium smoke particles by means of a light-foam generator and to bind them as natron lye or sodium-carbonate lye in the course of the foam generating or decay process. The tests brought some substantial results. Further improvements of the light-foam sodium particle removal method depend on the development of a good foaming, shortactive special foam with an ability to resist for approximately 2 minutes in connection with an adequate lay-out of the foam generator.

8309 Response spectrum method with residual terms. Biswas, J.K.; Duff, C.G. (AECL, Mississauga, Ont). *Am. Soc. Mech. Eng., [Pap.];* No. 78-PVP-79, 1-7(1978).

This paper presents a modification of the response spectrum method intended to be used for seismic analysis of systems and components in Nuclear Power Plants. It combines the response from the first few modes, together with residual terms to account for the higher modes. The conventional response spectrum method has the limitation that it produces responses lower than the actual at mode points close to the support. The proposed procedure rectifies this information and produces realistic responses at all points. The seismic response of an example tank is worked out using the proposed method. The results are compared with that obtained from the time-history method and found to have reasonable agreement. 5 refs.

8310 Safety index of nuclear concrete containment structures. Petrina, P. (Sargent and Lundy Eng, Chicago, Ill). *Am. Soc. Mech. Eng., [Pap.];* No. 78-PVP-106, 1-10(1978).

A major obstacle in probabilistic analysis is derived from the difficulty of adequately representing the variability of the random variables, particularly in the regions or rare occurrences, during the process of analysis. As a result, current methodologies for reliability-based design of structures are formulated in terms of statistics of the random variables (so-called second moment formats) in which only the means and the covariances are considered. The objective of this paper is to present a procedure for calculating the reliability of a concrete containment structure interms of safety index when the random variables entering into design equations are defined by their probabilistic distribution function. This is accomplished by means of mapping the random variables into standardized Gaussian variables. The evaluation of safety index is greatly facilitated by selecting a polynomial function to approximate the transformed variable. The proposed approach provides a means for extension of the reliability index from second moment formats toward a proabilistic format. The procedure is illustrated for a post-tensioned concrete containment structure involving failure modes typical for the cylindrical shell. Selected design cases involving structural loads caused by the seismic motions and the loss-of-coolant accident are particularly emphasized. 7 refs.

8311 FRAP fuel behavior computer codes. Oehlberg, R.N.; Johnston, W.V.; Dearien, J.A. *Nucl. Saf.;* **19**: No. 5, 565-589(1978).

The Fuel Rod Analysis Program (FRAP) computer codes being developed by the Nuclear Regulatory Commission (NRC) are reviewed. The FRAP-S (the steady-state code) is designed to provide initial conditions for FRAP-T (the transient code). The models contained in each code, the ability of the recent versions of the codes to predict experiments, and judgments as to the codes' strengths and weaknesses are presented. Future development of the FRAP-T code is discussed, and a listing of potentially desirable models for the NRC transient and steady-state codes are displayed. The content of the Material Properties Package (MATPRO) is outlined. The modular MATPRO is actively linked to both FRAP-T and FRAP-S to provide a well-documented and consistent set of material properties for the FRAP codes.

8312 Assessment of seismic trip systems for commercial power reactors. Cummings, G.E.; Wells, J.E.; Lambert, H.E. *Nucl. Saf.;* **19**: No. 5, 590-601(1978).

The article assesses the value of seismic trip (scram) systems on commercial nuclear power reactors. Experiences with seismic trip systems on research and test reactors are reviewed as are current regulations concerning seismic instrumentation on power reactors. The advantages and disadvantages of seismic trips are discussed, and a comparative risk assessment is made using fault tree techniques. Also explored is the possibility of using a precursor signal from an earthquake to trip the reactor before the arrival of strong motion.

8313 Two-dimensional vibration test and its simulation analysis for vertical slice model of HTGR core. Muto, K.; Uchida, K.; Takase, H. (Muto Inst. of Structural Mechanics, Inc., Tokyo (Japan)); Kuroda, T.; Murakami, H. *Nippon Genshiryoku Gakkaishi;* **19**: No. 12, 853-861(Dec 1977). (In Japanese).

The High Temperature Gas-cooled Reactor (HTGR) developed by the General Atomic Co. of U.S.A. is a nuclear reactor with high performance. The active core in case of large HTGR (1,100 MWe) is made up of fuel graphite blocks (about 8,000 blocks in total), all of which are stacked horizontally with a 4 mm clearance between each block. If an earthquake should occur, intricate behaviors due to collisions result as a great number of the blocks collide against one another. The present report is concerned with the two-dimensional vibration test of a vertical slice of the core and the computer simulation analyses. Namely, selecting a vertical slice across the center of the core, the forced vibration test of a 1/5 scale model was performed by using a shaking table to obtain such dynamic properties as resonant characteristics and vibration modes of the core. Together with the test, a computer code called COLLAN2-V was developed to simulate the test results. Consequently, it was clarified that the collision behaviors of the core could be analyzed by the computer.

8314 Applicability study on fault-tree-analysis code package SUPKIT. Kobayashi, Y. (Hitachi Ltd., Kawasaki, Kanagawa (Japan). Atomic Energy Research Lab.). *Nippon Genshiryoku Gakkaishi;* **19**: No. 11, 766-773(Nov 1977). (In Japanese).

A computer code package SUPKIT has been developed for the efficient evaluation of system reliability on the basis of fault-tree-analysis. SUPKIT calculates time-dependent system unavailability, evaluates component sensitivity to system failure and estimates the confidence bound of system unavailability, though it relies on the fundamental methodology of PREP-KITT used in "WASH-1400 Reactor Safety Study". The present report attempts to study the applicability of this calculation procedure as a numerical tool for the system reliability evaluation. In an application to a simplified ECCS, the obtained result is studied on the time-dependent behavior of minimal cut set and system unavailabilities, uncertainty propagation through minimal cut sets and component sensitivity to system unavailability. Our experience with SUPKIT recommends the research on the semi-automated fault-tree construction and more rough-and-ready method to estimate the confidence bound of system unavailability.

8315 Seismic analysis of thin cylindrical shells with attached masses. Kazimura, Y.; Shiraki, K. (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)); Shibata, H. *Nippon Kikai Gakkai Rombunshu;* **43**: No. 374, 3751-3760(Oct 1977). (In Japanese).

Recently, many thin axisymmetrical shell structures such as reactor containment vessels, cooling towers and LNG tanks have been constructed. The vibration mode of axisymmetrical shells consists of beam type vibration mode and high order vibration mode waving in circumferential direction. If shell structures are perfectly axisymmetric, the high order vibration mode, in which the center of gravity does not move, is not excited at the time of earthquakes, and the aseismatic analysis may take only the beam type vibration mode as the object. However recently, question has arisen in neglecting the high order vibration response. The analysis method for the high order vibration response by Shibata underestimated considerably as compared with the results of model experiments. In this study, in order to analyze the vibration of the axisymmetrical shells of any form with local masses, the function of natural vibration was expressed with the series of the characteristic functions as the axisymmetrical shells, and the phase was given to each characteristic function considering plural local masses. The vibration analysis was carried out by applying the strain energy and kinetic energy ob-

tained by the use of this series function to the Lagrange's equation. Moreover, the earthquake response was obtained by the model analysis method using the response spectra. The theory of this problem, the experimental method, and the comparison of the results of experiment and calculation are explained.

8316 PWR reactor. Winkler, F.; Helf, H. (to Kraftwerk Union A.G., Muelheim an der Ruhr (Germany, F.R.)). German(FRG) Patent 2,357,893/C/. 22 Sep 1977. 5p. (In German).

This is an emergency cooling system with accumulators for partial or complete failure of the primary circuit, with optimum coolant distribution over the spaces above and below the reactor core.

8317 Thermo-hydraulic behavior of fluid in pressure vessel during blowdown. Results and discussions of the experiments with the facility for the blowdown behavior of integrated type marine reactors. Nariai, H. (Ship Research Inst., Tokyo (Japan)); Nagatome, M.; Aso, S. *Senpaku Gijutsu Kenkyujo Hokoku;* **14**: No. 5, 283-333(Sep 1977). (In Japanese).

Thermo-hydraulic behavior of fluid in pressure vessel during blowdown was experimentally investigated with the Facility for the Blowdown Behavior of Integrated Type Marine Reactors. The dimensions of the pressure vessel used for the experiments were 284mm ID and about 1700mm height. 34 experiments were conducted with various combinations of following parameters: three orifice diameters (25.4, 12.7 and 6.4mm), three initial saturation pressures of fluid (50, 40 and 30kg/cm 2g), three break positions (upper, middle and lower), two liquid levels, and two volume numbers (with and without internals). Pressures in pressure vessel, differential pressures between upper and lower nozzles, and void fractions at vertically 6 points in pressure vessel were measured during blowdown. A computer code (BLODAC-IV) was developed to analyse the single volume blowdown characteristics. The code includes so-called bubble gradient model for the steam distribution in water and some input parameters. The experimental results of pressures, void fractions and falling speed of liquid level were compared with the calculational results, and the combinations of the values of input parameters were determined so that the results of calculations fit well for the experimental results. The blowdown characteristics and the combinations of input parameters were explained by the newly derived experimental results of void distributions in water.

8318 Examination on the safety of handling the fuel elements in the nuclear ship 'Mutsu'. *Genshiryoku Iinkai Geppo;* **22**: No. 7, 35-52(Sep 1977). (In Japanese).

This is the report of the Examination Committee on Total Inspection and Repair Technologies for Mutsu to the Director of Science and Technology Agency and the Minister of Transport dated July 29, 1977. The committee concluded before that the total inspection on safety and the repair of shielding can be carried out as the fuel elements are loaded, and the safety can be secured sufficiently. It was decided at the meeting of ministers concerned with Mutsu on May 17 that the safety concerning handling the fuel elements of Mutsu should be examined by the committee. Under the premise that the fuel elements are loaded again and used after the total inspection on safety and the repair of shielding, the committee examined the methods and the basic concept of safety about the taking-out, transport and preservation of the fuel elements, and the conclusions obtained are reported. The contents of the examination are the outline of the fuel elements, the present condition of the fuel elements, the safety concerning taking-out, transport and preservation of the fuel elements, and the other measures required for securing safety. The committee thinks that the safety can be secured sufficiently if the works are carried out carefully.

8319 Radiation monitoring around reactor installations. Imai, T.; Sato, T. (Japan Atomic Power Co., Tokyo). *Denki Gakkai Zasshi;* **97**: No. 9, 775-779(Sep 1977). (In Japanese).

The environmental radiation monitoring around reactor installations eventually aims at the health and safety of the local people. It must be carried out under a responsible system providing reliable data. The following matters are described: radioactivity release management, environmental monitoring plans and items of monitoring, responsible environmental monitoring system, and environmental monitoring carried out in the Tsuruga area, Fukui Prefecture.

8320 Fire protection in the nuclear power plant. Takuma, M. (Tokyo Electric Power Co., Inc. (Japan)). *Karyoku Genshiryoku Hatsuden;* **28**: No. 8, 712-716(Aug 1977). (In Japanese).

According to the publication by US NRC, 32 fires have occurred in the nuclear power stations in operation, but most of them were small fires, and did not affect the safety of the nuclear power stations. The largest fire was that which occurred in the Browns Ferry Nuclear Power Station of TVA, USA, in March, 1976. It did not jeopardize the safety of the reactor facilities, and the leak of radioactive substance did not occur at all. But the investigation was made extensively by the joint committee of both houses, the government and others, and the deficiency in the countermeasures to fire was found, and it was clarified that some revision would by required on the standard applied heretofore. It was the valuable experience for improving further the safety of nuclear power stations. The fire occurred by the ignition of the polyurethane for sealing cable penetrations due to candle flame for testing. About 1600 cables were burned. When fire breaks out in a nuclear power station, it is necessary to stop and cool the reactor without fail, and to prevent the leak of radioactive substances definitely. In case of the fire in Browns Ferry, these requirements were fulfilled satisfactorily. The countermeasures on the basis of the experience in Browns Ferry and the design of the counterplan to fire in nuclear power stations are explained.

8321 Aseismatic design of electrical equipments and instruments for nuclear power stations. Suzuki, Y.; Nishizawa, K.; Miyazaki, Y.; Miura, T. (Hitachi Ltd., Tokyo (Japan)). *Hitachi Hyoron;* **59**: No. 7, 567-572(Jul 1977). (In Japanese).

The aseismatic design of electrical instruments is carried out according to IEEE Standard 344-1971 in the USA. In Japan also, the method of aseismatic design of electrical instruments has been investigated by the representatives of electric power companies and electric machine makers since 1972. In Hitachi Ltd., the statical method of confirming aseismatic property was established on the basis of the rigid design for electrical instruments. It is convenient to examine the aseismatic property of electrical equipments by classifying them into control and switch boards, electrical appliances, equipments and circuits. It is possible to use the static method treating earthquake force as static load by avoiding resonance with the electrical equipments which have the higher natural frequency than that of buildings. The purposes of the vibration test are to prove the validity of the theoretical analysis, to clarify the vibration characteristics, and to confirm the maintenance of functions and the strength of the equipments. The vibration tests of control boards, the switch boards of enclosed type, motor control centers, the racks for instrumentation, storage batteries and electrical appliances are explained. Moreover, the vibration analysis with a computer according to finite element method is described.

8322 Pressure suppression system for a nuclear reactor. Jost, N. (to Kraftwerk Union A.G., Muelheim an der Ruhr (Germany, F.R.)). German(FRG) Patent 2,452,490/C/. 5 May 1977. 5p. (In German).

The invention pertains to a pressure suppression system for PWR reactors where the parts enclosing the primary coolant are contained in two pressure-tight separate chambers. According to the invention, these chambers are partly filled with water and are connected with each other below the water surface. This way, gases cannot escape from the containment, not even if a valve and a line are damaged at the same time, as the vapours released condensate in the water of at least one of the other chambers.

8323 Emergency cooling device for gas-cooled reactor. Thompson, R.E.; Pierce, B.L. (to Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). German(FRG) Patent 2,634,780/A/. 17 Feb 1977. 23p. (In German).

An emergency cooling device for gas-cooled nuclear reactors is described containing a coolant gas loop, with a heat exchanger, running through the reactor core. In order to be independent of external power sources, a gas turbine driven by the circulating coolant gas is connected to the coolant gas loop. The coolant gas expanded by it descharges its heat in the heat exchanger, is compressed afterwards, and fed into the core again. The gas turbine drives the compressor and a circulation pump. The plant is described in detail.

8324 Use of light foam for separating sodium oxide aerosols from the exhaust air of sodium fires. Menzenhauer, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung); Farrenkopf, D. (Karlsruhe Univ. (TH) (Germany, F.R.). Lehrstuhl fuer Reaktortechnik). *VFDB (Ver. Foerder. Dtsch. Brandschutzes) Z.;* **26**: No. 4, 133-135(1977). (In German).

It is investigated in how far sodium oxide aerosols and their chemical secondary products released during sodium fires in technical plants can be separated from the exhaust air by light foam, in the context of which the aerosols are bound mainly in the form of a sodium hydroxide solution during the course of the foam formation and decomposition process. Under the assumption that the foam generators are made in such a way that they produce short-lived foams, it is possible to achieve an almost complete separation with little investment.

8325 Pressure suppression device. Mizumachi, W.; Fukuda, A.; Kitaguchi, H.; Shimizu, T. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1977-100,076/A/. 18 Feb 1976. 5p. (In Japanese).

A method to relieve and absorb impact wave vibrations caused by steam and non-condensed gases releasing into the pressure suppression chamber at the time of an accident is presented. The reactor container is filled with inert gases. A safety valve attached main steam pipe is provided to permit the excessive steam to escape, the valve being communicated with the pressure suppression chamber through an exhaust pipe. In the pressure suppression chamber, a doughnut-like cylindrical outer wall is filled at its bottom with pool water to condense the high temperature vapor released through the exhaust pipe. A head portion of a vent tube which leads the exhaust pipe is positioned at the top, and a down comer and an exhaust vent tube are locked by means of steady rests. At the bottom is mounted a pressure adsorber device which adsorbs a pressure from the pool water.

8326 (CONF-7609179—2) **Studies of the structure, equipment and organization of personnel employed on inspection, maintenance and repair work in controlled areas of nuclear power stations.** Noack, J. 1976. Translation of Paper II/3. 9p. British Library Lending Div., Yorkshire, Eng.

From VGB conference on power stations; Stuttgart, F.R. Germany (7 Sep 1976).

The Directorate General for Industry and Technology of the European Communities has commissioned the firm Lahmeyer International to undertake a study on the use of personnel in controlled areas of nuclear power stations. This study was required to include a survey of personnel problems which had arisen previously in work in the controlled area, involving in particular: (a) the deterination of the numbers of personnel used for different activities during the operating year; (b) the breakdown of these personnel according to their origin (operative personnel from the power station, supplier firms, and others; and (c) a summary picture of the training qualifications of the personnel concerned. An estimate was to be made on the basis of the determined values of future personnel requirements in nuclear power stations, taking into account the increased use of nuclear energy. Detailed information on the use of personnel in various European nuclear power stations was requested by means of questionnaires. The questionnaire covered the numbers, radiation exposure, training, type, and origin of personnel used for various work in the controlled area. Data from a total of seven nuclear power stations are presented.

8327 **Nuclear reactor container.** Yamanari, S.; Horiuchi, T.; Sugizaki, T.; Tominaga, K. (to Hitachi Ltd., Tokyo (Japan)). Japanese Patent 1977-79,198/A/. 26 Dec 1975. 7p. (In Japanese).

A method to improve the safety of the container of a BWR type reactor by suppressing a sudden increase in pressure applied to a pressure suppression chamber at loss of coolant accident is described. Individual vent tubes inserted in a coolant within a pressure suppression chamber are arranged such that their respective discharge ports are at different depths with respect to the liquid level. In the initial stage after loss of coolant accident, air is discharged from the discharge ports of the individual vent ducts, forming bubbles in the coolant. However, discharge of air from the discharge ports of the vent ducts is slightly delayed. As a result, the maximum values of the respective downward and upward forces applied to the lower and upper walls of the pressure suppression chamber are made to occur substantially at the same time, whereby the net pressure synthesized is reduced in order to transiently suppress the pressure in the pressure suppression chamber.

8328 **Pressure suppression type reactor container.** Yanai, R.; Kagawa, T. (to Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa (Japan)). Japanese Patent 1977-81,497/A/. 26 Dec 1975. 3p. (In Japanese).

A method to enhance safety by preventing parts on the side of a pressure suppression vessel from being broken due to shocks caused by steam and non-condensed gas entering the pressure suppression chamber at the time of accident or inspection is described. When steam issues due to breakage of the primary cooling system connected to the pressure vessel, the steam and non-condensed gas in a dry well tank are led through a connecting duct, branch ducts and guide ducts and discharged from the discharge ports of at least one pair of branch ducts extending parallel to each other. Since the discharge ports are formed on opposing walls provided in each branch duct, the fluid issuing from the opposite side discharge ports is subjected to agitation below the water level. Sharp variations in the liquid level are prevented from taking place so as to preclude breakage of ducts and the pressure suppression chamber.

ENERGY STORAGE

MAGNETIC

REFER ALSO TO CITATION(S) 9345

8329 (LA—7294-PR) **Superconducting Magnetic Energy Storage (SMES) program. Progress report, January 1—December 31, 1977.** Rogers, J.D. (comp.). (Los Angeles County Harbor General Hospital, Torrance, CA (USA)). Aug 1978. Contract W-7405-ENG-36. 46p. Dep. NTIS, PC A03/MF A01.

Work is reported on the development of two superconducting magnetic energy storage units. One is a 30-MJ unit for use by the Bonneville Power Administration to stabilize power oscillations on their Pacific AC Intertie, and the second is a 1- to 10-GWh unit for use as a diurnal load leveling device. The design of the stabilizing unit has been carried through the conceptual design phase, and a reference design of the diurnal storage unit is in preliminary draft form. There are plans to build a 10- to 30-MWh prototype unit.

8330 (LA-UR—78-1213) **Superconducting magnetic energy storage for electric utilities and fusion systems.** Rogers, J.D.; Boenig, H.J.; Hassenzahl, W.V. (Los Alamos Scientific Lab., NM (USA)). 1978. Contract W-7405-ENG-36. 45p. (CONF-781025—1). Dep. NTIS, PC A03/MF A01.

From Instrument Society of America meeting; Philadelphia, PA, USA (16 Oct 1978).

Superconducting inductors provide a compact and efficient means of storing electrical energy without an intermediate conversion process. Energy storage inductors are under development for load leveling and transmission line stabilization in electric utility systems and for driving magnetic confinement and plasma heating coils in fusion energy systems. Fluctuating electric power demands force the electric utility industry to have more installed generating capacity than the average load requires. Energy storage can increase the utilization of base-load fossil and nuclear power plants for electric utilities. The Los Alamos Scientific Laboratory and the University of Wisconsin are developing superconducting magnetic energy storage (SMES) systems, which will store and deliver electrical energy for load leveling, peak shaving, and the stabilization of electric utility networks. In the fusion area, inductive energy transfer and storage is being developed. Both 1-ms fast-discharge theta-pinch systems and 1-to-2-s slow energy transfer tokamak systems have been demonstrated. The major components and the method of operation of a SMES unit are described, and potential applications of different size SMES systems in electric power grids are presented. Results are given of a reference design for a 10-GWh unit for load leveling, of a 30-MJ coil proposed for system stabilization, and of tests with a small-scale, 100-kJ magnetic energy storage system. The results of the fusion energy storage and transfer tests are presented. The common technology base for the various storage systems is discussed.

COMPRESSED GAS

8331 **Thermal power plant with compressed air storage.** Gyarmathy, G.; Pfenninger, H. (to BBC Brown Boveri and Co.). US Patent 4,100,745. 18 Jul 1978. Priority date 15 Mar 1976, Switzerland. 4p.

The invention discloses a thermal power plant of the type in which excess energy produced by the plant during off-peak load periods is used to produce compressed air which is then accumulated in a storage tank. The compressed air is withdrawn from storage during peak load periods and delivered to a hot air turbine for generation of additional energy. A heat exchanger is incorporated in the compressed air line leading from the storage tank to the hot air turbine and steam is supplied to the heat exchanger for heating the compressed air prior to delivery to the hot air turbine. Heating steam can be produced by electrically heating water in a storage tank or it can be constituted by bleeder steam taken from an auxiliary steam turbine facility, or it can be taken from a steam storage tank.

FLYWHEELS

8332 (UCRL—13895) **Flow and failure behavior of fiber-reinforced epoxy matrix polymeric composites. Final technical report.** Mjkherjee, A.K.; Abercrombie, D. (California Univ., Davis (USA). Dept. of Mechanical Engineering). 1977. Contract W-7405-ENG-48. 68p. Dep. NTIS, PC A04/MF A01.

The high temperature creep and tensile test behavior of continuously reinforced Kevlar PRD 49 III strands is investigated. Investigation is augmented by scanning electron microphotographs and acoustic monitoring of specimens. It is concluded that deformation is elastic and that failure occurs by stress and temperature assisted activated-breaking of primary bonds. This occurs at the

worst flaw locations of the narrow distribution of flaws inherent to the fibers. Since the distribution of flaws is narrow, the failures are characteristically abrupt. The creep characteristics are excellent because normal creep loads are not high enough to activate sufficient numbers of flaws to instability. At these low loads, fiber breaks do not occur, and the creep rate continuously approaches zero as the fairly insignificant mechanism of creep is exhausted.

THERMAL

REFER ALSO TO CITATION(S) 7877, 7878, 7879, 8339, 8457

8333 (ANL/SPG—3) **Assessment of energy storage technologies and systems. Phase II: heat pump and solar energy applications.** Asbury, J.; Caruso, J.; Giese, R.; Mueller, R.; Akridge, L.; Heitner, K.; Molander, A.; Moritz, P. (Argonne National Lab., IL (USA); TRW, Inc., McLean, VA (USA)). Mar 1978. Contract W-31-109-ENG-38. 37p. Dep. NTIS, PC A03/MF A01.

An analysis of the cost-effectiveness of thermal energy storage (TES) systems in heat pump, solar energy, and competing-system applications is described. The energy storage technologies evaluated interface with conventional electric utility supply systems. In winter-peaking service areas, storage and bivalent heat pump and resistance heating technologies were found to offer substantial savings relative to conventional heat pump and direct resistance heating systems. In summer-peaking service areas, a hybrid heat pump-diurnal ice storage system is the most efficient technology for year-round space conditioning. The TES commercialization program recommended here includes: design and implementation of economically efficient electric rates, field demonstrations to establish technical and economic viability of TES systems in U.S. markets, appliance performance-safety certification, and improved TES performance through development of advanced TES concepts. Development of phase change material (PCM) storage appears to hold substantial promise for reducing the cost of residential heating and cooling. Accordingly, a strong research effort to develop and validate PCM storage is recommended.

8334 (CONF-771131—, pp 181-190) **HYCSOS: a chemical heat pump and energy conversion system based on metal hydrides.** Gruen, D.M.; Sheft, I.; Lamich, G.; Mendelsohn, M.H. (Argonne National Lab., IL). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

Design and construction features of the ANL demonstration test facility which utilizes four stainless steel tanks holding 10 lbs. each of either $LaNi_5$ or $CaNi_5$ are given. The operation, instrumentation and control of the system are detailed with the aid of photographs, drawings and a system layout diagram. Initial operation of the system has shown that 33 moles of hydrogen can be transferred from $LaNi_5$ at approximately 8°C to reform $CaNi_5H_4$ at 40°C with cycle times approaching 2 minutes for 50% hydrogen transfer. The relevant data pertaining to these experiments are given in graphs and tables. The program for FY 1978 includes work on a fully automated and insulated system to establish a firmer data base, obtain power balances and determine optimum operating parameters. In order to achieve these goals in a reasonable time frame, a data display and handling system is being installed. A second generation heat exchanger based on aluminum foam technology will be tested. A materials development program is being carried out concurrently with HYCSOS operations. Significant process is being made in the development of new, ternary alloy systems, based on the composition LaNi/sub 5-x/Al/sub x/ which display superior properties for heat pump action. An economic and performance analysis is being carried out to evaluate the potential of the HYCSOS system for commercialization.

8335 **Dual temperature thermal energy storage composition for heat pumps.** Spauschus, H.O.; Loeb, L. (to General Electric Co.). US Patent 4,100,092. 11 Jul 1978. Filed date 20 Apr 1977. 8p.

The invention discloses a combination thermal energy storage material capable of functioning in two discrete temperature ranges and comprised of two constituents, one of which has a phase change in the low temperature range between about 35°F and about 55°F and the other of which has a phase change in the high temperature range of between about 90°F and about 130°F. Both temperature ranges are selected to correspond with the operable and desirable ranges for a heat pump operation. The two constituents are selected to be non-reactive with one another and in the mixture maintain independent phase change characteristics. However, the mixture itself alters in some cases, depending upon concentration, the melting points of each member of the pair so that the transition temperatures of the phase changes in the mixture are somewhat different and somewhat lower than the phase changes characteristic of the independent constituents and is dependent upon the concentration of the constituents in the mixture. The pairs of materials selected can, therefore, function in the heat pump environment to provide a heat sink into which heat may be dissipated for air-cooling purposes as well as a heat source which provides heat for heating purposes. Preferred pairs of materials include (a) a hydrocarbon oil paired with a wax fraction; (b) a C_8 fatty acid paired with a C_{14}—C_{18} fatty acid; (c) a C_{10}—C_{12} alcohol with a C_{14}—C_{18} fatty acid; and (d) a C_{10}—C_{12} alcohol with a wax fraction. Preferred weight percent of the components are also selected to conform to the high and low transition temperature ranges used as parameters.

8336 **Method of heat accumulation and a thermal accumulator for the application of said method.** Bricard, A.; de Cachard, M.; Goffinet, P.; Kurka, G.; Moracchioli, R. (to Commissariat a l'Energie Atomique). US Patent 4,099,558. 11 Jul 1978. Priority date 1 Mar 1974, France. 10p.

A heat-transporting fluid F is passed over a material C having a high latent heat of fusion and in direct contact therewith so that the fluid and the material exchange heat at a temperature close to the melting point of the material. By contacting the hot fluid F with the material C, this material melts and accumulates heat in the form of latent heat of fusion while cooling the fluid F. When the cold fluid is contacted directly with the material C, this material solidifies and releases heat which is transmitted to the fluid F.

8337 **Method of heat accumulation and a thermal accumulator for the application of said method.** Bricard, A.; de Cachard, M.; Goffinet, P.; Kurka, G.; Moracchioli, R. (to Commissariat a l'Energie Atomique). US Patent 4,099,557. 11 Jul 1978. Filed date 6 Dec 1976. 12p.

A heat-transporting fluid F is passed over a material C having a high latent heat of fusion and in direct contact therewith so that the fluid and the material exchange heat at a temperature close to the melting point of the material. By contacting the hot fluid F with the material C, this material melts and accumulates heat in the form of latent heat of fusion while cooling the fluid F. When the cold fluid is contacted directly with the material C, this material solidifies and releases heat which is transmitted to the fluid F.

CHEMICAL

REFER ALSO TO CITATION(S) 7878, 7879, 8442

8338 (CONF-771131—, pp 234-245) **Solar-chemical energy conversion and storage: cyclohexane dehydrogenation.** Ritter, A.B.; DeLancey, G.B.; Schneider, J.; Silla, H. (Stevens Inst. of Tech., Hoboken, NJ). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

The concept of storing excess Thermal Energy as chemical bond energy and the subsequent recovery of this energy on demand by utilizing reversible catalytic chemical reactions shows great promise from an energy density point of view. In the intermediate temperature range (400 to 800°F) the cyclohexane-benzene reaction appears to be the most appropriate. While this reaction has been extensively studied in the exothermic direction, little useful design data exists for the endothermic reaction. We have studied the apparent kinetics of the gas-phase catalytic decomposition of cyclohexane to benzene in an internally recirculated (gradientless) reactor over the temperature range 400 to 600°F. At low space velocities (high conversions) a maximum of 0.2% of the product formed in a single pass over a commercially available naphtha reforming catalyst is side products which may or may not be reversible. At high space velocities, there are significant mass transfer limitations on conversion. A test loop has been designed to enable us to study the buildup of side products and catalyst activity behavior during long term continuous cycling of the reversible reaction.

8339 (SAND—78-8682) **Sulfuric acid—water chemical heat pump/energy storage system demonstration.** Clark, E.C.; Hiller, C.C. (Sandia Labs., Livermore, CA (USA)). Aug 1978. Contract EY-76-C-04-0789. 9p. (CONF-781202—1). Dep. NTIS, PC A02/MF A01.

From ASME meeting; San Francisco, CA, USA (10 Dec 1978).

A chemical heat pump/thermal energy storage system has been designed, fabricated, and successfully tested under U.S. Department of Energy (DOE) funding. This first operational chemical heat pump is a key milestone in DOE's long-term thermal energy storage goals. The sulfuric acid/water chemical heat pump is suitable for both heating and cooling and has an inherent energy storage capabil-

ity. Long-term storage appears promising for this system because the chemicals are stored at ambient temperature and are inexpensive. Moreover, temperatures required for charging (150 to 400°F) are suitable for low-cost solar collectors; and both the mass and volumetric energy storage densities are considerably higher than alternatives such as ice or hot water storage. A summary of the research work conducted to date, including experimental test results is presented, and the applications, advantages, and factors affecting commercialization are discussed.

BATTERIES

DESIGN AND DEVELOPMENT

REFER ALSO TO CITATION(S) 8539

8340 (CONF-780852—1) **Review of industrial participation in the ANL lithium/iron sulfide battery development program.** Gay, E.C.; Miller, W.E.; Malecha, R.F.; Elliott, R.C. (Argonne National Lab., IL (USA)). 1978. Contract W-31-109-ENG-38. 26p. Dep. NTIS, PC A03/MF A01.

From 13. IECEC conference of the Society of Automotive Engineers; Detroit, MI, USA (20 Aug 1978).

Lithium/iron sulfide batteries are being developed at Argonne National Laboratory (ANL) for use as power sources for electric vehicles and for stationary energy storage devices for load leveling. An important part of the battery program involves subcontracts with various industrial firms. The objectives of the industrial subcontracts are to transfer the ANL technology to industry, augment the cell and battery development conducted at ANL, develop sources for materials and components, develop fabrication procedures, and fabricate test cells and batteries. This paper describes the nature of the industrial participation in the ANL Battery Program and the progress that has been made in the development and fabrication of industrial cells. Early in 1975, ANL initiated cell development and fabrication contracts. Since the initiation of cell fabrication by the industrial firms, ANL has fabricated only small research cells and engineering cells with unique features. In order to evaluate progress in the development of cells fabricated by industrial subcontractors, ANL has used automated qualification testing. Industrial cells that contained FeS_2 in the positive electrode have achieved a specific energy of 100 Wh/kg at a 4-h discharge rate and a peak power of 100 W/kg. Some of these cells have shown good performance for up to 300 deep discharge cycles. Industrial cells that contained FeS in the positive electrode have maintained good performance through 1000 deep discharge cycles. Present cell development efforts are directed toward improving specific energy and power in the cells that contain FeS and improving cycle life in cells that contain FeS_2. In 1978, ANL initiated a contract for the development of a full-scale electric vehicle battery. 8 figures, 3 tables.

PERFORMANCE AND TESTING

8341 **Sodium—sulphur cells.** Foulkes, F.R.; Choi, P.T. (Univ. of Toronto). *Can. J. Chem. Eng.;* **56**: No. 2, 236-245(Apr 1978).

The sodium—sulfur battery is reviewed and experimental results are presented. The experimental cells were capable of delivering steady-state power densities as high as 50 W kg^{-1} and energy densities as high as 250 Wh kg^{-1}. The theoretical open circuit voltage of 2.08 V was observed in all cases. Cell polarization was limited by cell internal resistance, which was attributed largely to the resistance of the β-alumina electrolyte. The "asymmetry effect" is explained in terms of an electrode blockage mechanism involving polysulfides. The sodium—sulfur battery appears to be technically feasible as the power source for an all-electric vehicle. 5 figures, 5 tables, 150 references.

MATERIALS, COMPONENTS, AND AUXILIARIES

REFER ALSO TO CITATION(S) 8620

8342 **Lighter lead storage battery.** Sassmannshausen, G.; Hasenauer, D. (to Accumulatorenwerk Hoppecke Carl Zoellner and Sohn). US Patent 4,093,785. 6 Jun 1978. Priority date 20 Jan 1976, German, Federal Republic of (F.R. Germany). 6p.

A lead storage battery with positive and negative plates is described, the contact lugs of which respectively are connected with one another by lug bridges. The grid upper part of each plate grid is covered with an acid resistant synthetic material covering, which synthetic material covering surrounds the contact lugs acid tight, the synthetic material covering being connected acid tight with the cell cover or one-piece composition case cover. The lug bridges are connected with one another outside of the acid space of the contact lugs. 7 figures.

8343 **Energy from crystal defects: lithium nitride in solid-state batteries. Research results of the Max-Planck-Institut fuer Festkoerperforschung.** *Chem. Lab. Betr.;* **29**: No. 6, 221-222(Jun 1978). (In German).

Research activities of the Max-Planck-Institut fuer Festkoerperforschung revealed that lithium nitride is a Li-ion conductive solid-state electrolyte for Li secondary batteries, even at room temperature. Compared to the energy density of 30 Wh/kg of conventional lead accumulators, Li_3N batteries are expected to have energy densities of about 200 Wh/kg.

8344 **Automatic electric battery charging apparatus.** Foster, G.W. (to Chloride Group Ltd.). US Patent 4,091,320. 23 May 1978. Filed date 18 Aug 1976. 8p.

An automatic battery charging apparatus is described in which a control signal is generated by subtracting a signal representing a fraction of the supply voltage from the battery voltage so that the control signal represents the state of charge of the battery irrespective of variations in the supply voltage. The charge is terminated when the rate of rise of the control signal falls below a predetermined value; this condition is sensed by sampling the output frequency of a voltage-controlled oscillator, the frequency of which is directly proportional to the control signal. In one arrangement the output frequency is fed to an up—down counter for a sampling period (2 minutes) with the counter counting up and then, after an interval of 30 minutes, the output frequency is fed to the counter for a further sampling period (1 minute 55 seconds) with the counter counting down. If the counter fails to return to zero at the end of a down count the charge is terminated.

8345 **Battery chargers for aircraft.** Mueller, P.F.; Tauber, G.; Wild, G. (Siemens, Erlangen, Ger). *Siemens-Z.;* **52**: No. 4, 206-209(Apr 1978). (In German).

Aircraft batteries have a very important safety function and must therefore always be optimally charged. The article describes two battery chargers of small weight and size and explains their function and use in various types of aircraft systems. Constant-voltage charging and charging in accordance with a current-voltage characteristic are compared.

ENERGY MANAGEMENT AND POLICY

REFER ALSO TO CITATION(S) 7269, 7880, 8494

8346 **Annual review of energy. Volume III.** Hollander, J.M.; Simmons, M.K.; Wood, D.O. (eds.). Palo Alto, CA; Annual Reviews Inc. (1978). 551p. Annual Reviews Inc., 4139 El Camino Way, Palo Alto, CA.

A separate abstract was prepared for each of the thirteen papers presented in this 1978 annual review. (MCW)

8347 **Energy technology handbook.** Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977). 1857p. $49.50.

Prepared by 142 specialists.

The handbook sets forth the fundamentals and basic data on today's major energy sources, the latest energy conversion processes, energy transportation and transmission, and the most promising trends in power technology. A separate abstract was prepared for each of the 128 individual sections for the Energy Data Base (EDB) and Energy Research Abstracts (ERA); 15 of the items were included in Energy Abstracts for Policy Analysis (EAPA).

ENERGY ANALYSIS AND MODELING

REFER ALSO TO CITATION(S) 8351, 8367, 8394, 8405, 8408, 8426

8348 (BNL—24821) **Technological-economic models for energy analysis.** Hoffman, K.C. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 21p. (CONF-780843—4). Dep. NTIS, PC A02/MF A01.

From Conference on net energy analysis and energy modeling; Colorado Springs, CO, USA (21 Aug 1978).

The energy system and economic models described in this paper are designed for general usage in government and industry. Most energy-policy issues and decisions involve a complex mix of technical, economic, environmental, and social value considerations. Specific policy actions addressing any one of these elements can have significant effects on the others, frequently in direct conflict with other policy objectives. Many of the important attributes of energy policy, such as resource requirements, demand, environmental effects, prices, and trade, are expressed in quantitative terms and are subject to known physical and economic relations. While most of

these are relatively simple when taken individually, a comprehensive set of relationships must be assembled and integrated in order to capture the complexities of the entire scope of energy policy. The resultant system involves a blend of theory and practice from the scientific, engineering, and economic disciplines supported by the methods of applied mathematics, operations research, systems analysis, and computer science. The models described here are based primarily on engineering and economic relationships; social, legal, and institutional factors that bear on value judgments and nontechnical, noneconomic constraints are not incorporated. The methodology employed for energy analysis and technology assessment consists of three building blocks: (1) A network diagram portrays the technical structure of the energy system--the Reference Energy System and Supporting Data Base; (2) a linear-programming model provides a technique for system design and synthesis--the Energy System Optimization Model (BESOM and variants); and (3) a set of process models represents the technological options in major energy-use sectors--residential- and commercial-space conditioning, steel, aluminum, paper, cement, and chemicals.

8349 Merits and limits of energy analysis. Boiteux, M. (Electr de Fr). *Rev. Energ.;* **29**: No. 302, 127-131(Mar 1978). (In French).

Among the possible shortages which could affect the future of humanity, one must consider possible shortages of qualified workers and farmable land much more than possible energy shortages. The mineral resources of the earth's crust are obviously limited. The world will face a shortage of copper before it faces a lack of energy. It will cruelly lack phosphorus, and concerning the earth's albedo, the negative results of concrete constructions will not be negligible. In order to make a balanced judgment concerning the activities of humanity and the value of the techniques used, it appears to be completely unreasonable to limit oneself to an energy analysis.

ECONOMICS AND SOCIOLOGY

REFER ALSO TO CITATION(S) 8348, 8368, 8369, 8381, 8392, 8393, 8395, 8396, 8398, 8399, 8408, 8430, 8432, 8878

8350 Nuclear power from the point of view of the population. *At. Inf.;* No. 3, 3-4(Mar 1978). (In German).

The construction of a nuclear power station is regarded chiefly positively by the population, even if discomfort and antipathy to a new energy source prevent emotional identification with it. This, briefly, is the central finding out of an extensive investigation by KFA, Juelich, on the the views of the population on nuclear power. The study compares data of a domestic inquiry in 1975 and 1976 with the results of new investigations by commercial institutions and research centres.

8351 Demometrics for regional development. Ledent, J. *Options (IIASA);* 1-2(Sum 1978).

The interactions of population growth and economic growth (demometrics) are examined on a regional basis using systems analysis to explain demographic and economic phenomena and to forecast future developments. Past constraints on this type of modeling are due to inadequate and inconsistent data and to inadequate theories on regional growth. A simple model designed for the Tuscon, Arizona area substitutes multiplier analysis for the traditional export-base equilibrium model with enough success to merit further development of the model.

8352 Manpower use and requirements in OAPEC states. Al-Wattari, A.A. *OAPEC News Bull.;* **4**: No. 10, 16-24(Oct 1978).

The capital-intensive petroleum industry employs only a small, largely skilled labor force, which has social and economic implication for over-populated areas. The constraints imposed on other sectors and downstream industries by industrialization and the transfer of high technology has kept the Arab world's employment level little more than half that of the industrialized nations. The employment of large numbers of high-cost, highly trained foreign workers in Arab countries indicates the need for manpower training and development. Efforts to remedy this situation are evident in the planning for regional literacy and vocational training programs and in professional development at the Arab Petroleum Training Institute. The results of a manpower survey and educational goals are summarized.

8353 Dominant-firm pricing policy in a market for an exhaustible resource. Gilbert, R.J. (Univ. of California, Berkeley). *Bell J. Econ.;* **9**: No. 2, 385-395(Aut 1978).

The paper describes a von Stackelberg model of pricing behavior by a dominant firm in a market for an exhaustible resource. The results obtained differ dramatically from those that characterize a pure monopoly. If the marginal production cost in the competitive fringe is constant, the optimal dominant-firm price strategy is independent of its own costs and is determined by the characteristics of the fringe. The market price rises monotonically until the reserves of the fringe are exhausted. In contrast, if the production cost of the fringe is constant only up to a capacity constraint, the cartel may maximize profits by acting as a classical limit-pricing firm. 27 references.

8354 Don McCammond: renewing confidence. *EPRI J.;* **3**: No. 7, 20-25(Sep 1978).

Public relations expert Don McCammond recommends candid communication as the best vehicle for building customer confidence in the utilities. He feels customers need to know when there is bad news and how the utility plans to solve its problems. Using his own company, Virginia Electric and Power Co. to illustrate his approach, he describes ways of informing customers about rising generating costs. These include a customer booklet, store window displays, and television spots. He stresses the value of the service provided by electric utilities and the fact that utility rates have generally risen slower than the overall cost-of-living. He also feels customers will react favorably when they know the investment utilities have committed to energy research.

8355 Sources of economic growth in Latin American countries. Elias, V.J. (Univ. of Tucuman). *Rev. Econ. Stat.;* **60**: No. 3, 362-370(Aug 1978).

The growth-accounting approach is used to see what economic growth the seven major Latin American countries have experienced and which experiences are common. The purpose is to determine which economic policies are conducive to growth. Statistics for the 1940 to 1974 period are presented on gross domestic product (GDP), the share of labor in terms of gross input (employment) and the quality component, and capital input. A comparison of these statistics shows a relationship between the rates of change in GDP and the total inputs in that countries experiencing extremely high or low rates of GDP growth had corresponding rates of capital-labor inputs. Labor quality was an important component in most countries in contrast to capital quality. 34 references.

8356 Consumer-revealed preference for environmental goods. Getz, M.; Huang, Y. (Vanderbilt Univ., Nashville). *Rev. Econ. Stat.;* **60**: No. 3, 449-458(Aug 1978).

The production activity of cities is used to identify labor supplies in relation to the hedonic prices people are willing to pay for urban amenities. A model is developed to consider the economic, social, and environmental attributes of cities and the influence these factors have on where workers choose to locate. Professional groups are the least responsive to factors other than their work. After cost of living and earnings are taken into account, sex ratios, health, education, and crime prevention have a stronger influence than climate on locational choices. Many factors, such as air quality and commuting time, are significant to only one group of workers. 12 references.

8357 Choice of large projects. Harris, R. (Queen's Univ., Kingston, Ont.). *Can. J. Econ.;* **11**: No. 3, 404-424(Aug 1978).

Conventional cost/benefit or project analysis has generally not taken into account circumstances in which the project under consideration is large enough that its introduction to the economy would have significant general equilibrium effects. In this paper, rules are examined that would indicate whether such large projects should be accepted or rejected. The rules utilize information yielded by before-project and after-project equilibrium prices and production data. Rules are developed for the undistorted "first-best" case, the case in which the fixed costs of the project are covered by distortionary taxation, and for the case of projects producing public goods. 34 references.

8358 Small cars, large cars, and the price of gasoline. Blomqvist, A. (Univ. of Western Ontario, London); Haessel, W. *Can. J. Econ.;* **11**: No. 3, 470-489(Aug 1978).

Recently, the question of small vs large cars has assumed increasing importance because of their differential fuel economy and impact on energy consumption. This paper estimates disaggregated demand functions for cars by size and age class, with particular attention to the effects of gasoline prices on the composition of demand. The data consisted of a cross-section of five-year time series from eight Canadian provinces. Evidence was found of a substantial response of the demand composition to changes in the relative car prices; the evidence on the effect of gas prices was less conclusive. 20 references.

8359 Vertically integrated multinationals: a microeconomic analysis. Eden, L.A.B. (Mount St. Vincent Univ., Halifax, N.S.). *Can. J. Econ.;* **11**: No. 3, 534-546(Aug 1978).

One important topic in the literature on the pricing policies of vertically integrated multinational corporations has been the choice of a transfer price, the price charged by one affiliate of a multinational in commodity transactions with another affiliate of the same enterprise. In a 1976 paper (L'actaralite Economique, 324-52 (July to

Sept.)), assuming that international tariff and tax differentials constrain the multinational, Copithorne has shown that products transferred between divisions may have two transfer prices, an internal shadow price based on marginal cost, and an external price for tax and tariff authorities. The shadow price can be obtained without any reference to the money transfer price except where costs and revenues of the corporation are affected by these transfer prices. In this paper, the Copithorne model is first developed under the assumptions of free trade among the corporation's subsidiaries to include intrafirm trade in both primary products and secondary products. Then the model is expanded to deal with the effects caused by the introduction of profit taxes and tariffs. This paper shows how profit taxes and tariffs through the influence of money-transfer prices constrain the multinational enterprise and cause it to alter its resources-allocation decisions; it also deals with secondary trade among subsidiaries, a subject omitted by the other literature. By affecting cost and revenue functions, money-transfer prices can affect the shadow prices of primary and secondary output and, therefore, affect intrafirm trade flows by both primary and secondary divisions.

8360 Saudi Arabia: the power of the purse-strings. Turner, L. (Chatham House, London); Bedore, J. *Int. Affairs;* **54**: No. 3, 405-420(Jul 1978).

There are two different levels on which Saudi Arabia's foreign policy can be analyzed. First, there is the level of day-to-day policymakers who know that decisions in Riyadh can affect the U.S. balance of payments, the future of the dollar, the rate of world economic recovery, and even the eventual fate of Israel. Second, the sudden emergence of Saudi Arabia as a regional-cum-global power throws fascinating light on the emerging international order. After discussing the power and influence that petrodollar surpluses and the country's control over the world's key oil deposits have brought Saudi Arabia, the authors conclude that the country emerges with immense economic power. As key decision maker within OPEC, Saudi Arabia must take at least partial blame for plunging the world into recession during 1974 and 1975--and there are few other countries with that sort of power. On the other hand, the obligations its economic importance imposes are seen. The various uses of oil as a political lever are clumsy in their effects. Financial holdings lose their potency if they must be invested in troubled economies. But the memory of what happened in 1973—1974 remains, and it is enough to warn the OECD countries that there is a point beyond which Saudi Arabia cannot be pushed without doing major damage to the world economy. This should ensure that Saudi concern about Israel will be kept at the forefront of policymakers' minds throughout the world.Despite the fact that it is possible to buy most kinds of weapons from countries other than the U.S., the Saudis still need outsiders as ultimate guarantors of their strategic well-being. In economic terms, then, Saudi Arabia is a world power. In strategic ones, it is still struggling to find an adequate regional role. (MCW)

8361 Crisis in regional economic cooperation (integration) among developing countries: a survey. Vaitsos, C.V. (Sussex Univ., Brighton, Eng.). *World Dev.;* **6**: No. 6, 719-769(Jun 1978).

This article analyzes the meaning, theory, and key policy instruments of economic integration among LDCs and reviews the experience of various regional cooperation efforts in the Third World. It starts from the basic premise that economic integration is not an end in itself nor are its outcomes value-free; rather, its social legitimacy depends on the socio-economic and political interests served by regional cooperation. Power-commanding local hegemonic groups as well as foreign economic and political actors (governments and the transnational enterprises) play a determining role in the orientation, content, and performance of regional cooperation. The article also explores the implications for integration of certain structural economic characteristics of LDCs involving key production, technological, trade, and distributional considerations. They are interpreted as calling for regional cooperation mechanisms which are non-holistic in the sense that they are directed towards the fulfilment of specific objectives, activities, and tasks which require (a) programmed yet not comprehensive harmonization policies, (b) a subordination of trade to a planned and significant expansion of economic activities in new fields, and (c) the pursuit of certain outcomes whose values are not adequately reflected by the market system and whose inducement requires more explicit government intervention. Finally, the article argues that since regional cooperation is by its nature conflict-prone and subject to strong polarization forces, and since, furthermore, the above-raised considerations call for a significant role to be played by the member countries' governments, the viability of the process is subject to a continuous commitment and manifestation of political support. 244 references.

8362 Regional economic cooperation among developing countries: some further considerations. Robson, P. (Univ. of St. Andrews, Fife, Scotland). *World Dev.;* **6**: No. 6, 771-777(Jun 1978).

Peter Robson offers further comments on a paper Crisis in Regional Economic Cooperation (Integration) among Developing Countries: A Survey by Constantine Vaitsos in World Development, June 1978. He wonders if the approach espoused by Vaitsos may even now need reappraising. Robson adds further that market integration through trade liberalization has had only a limited impact on growth and very little impact on structural change and, through the imbalance created, has raised political obstacles to cooperation before substantial economic gains have been generated. The new emphasis gives pride of place to cooperation for production on a regional basis. It is now widely accepted that integration of this kind has an important role to play--at any rate if acceptable instruments are utilized to provide the necessary preferential support. But the implications for this kind of integration of the objective of promoting international cooperation among developing countries outside the framework of integration groupings have also to be taken into account, as have those of an international development strategy involving the development of manufacturing production in developing countries to serve not only the needs of advanced countries but particularly those of other developing countries. These objectives point not only to a strengthening of the links of developing countries with advanced countries--for instance, through the conclusion of industrial collaboration agreements--but also towards an increased emphasis on broader preferential collaboration arrangements in trade and other matters among the developing countries themselves. The consequences of progress in these directions for regional-integration approaches based on cooperation for industrial production could be far-reaching.

8363 Can the broken Humpty-Dumpty be put together again and by whom. Comments on the Vaitsos survey. Wionczek, M.S. (El Colegio de Mexico, Mexico City). *World Dev.;* **6**: No. 6, 779-782(Jun 1978).

Comments are made by Miguel S. Wionczek on a paper, Crisis in Regional Economic Cooperation (Integration) among Developing Countries: A Survey by Constantine V. Vaitsos in World Development, June 1978. Wionczek feels that the Viatsos story offers a highly useful intellectual message for economists and political scientists in the North, but that it contains little news for those people who, after having been directly or indirectly involved in the largely frustrated attempts to build economic integration schemes in the South, have realized around 1970 that most of these arrangements were bound to fail because of their dysfunctionality. Practically all these schemes were attempting, with traditional, very committed means, borrowed mostly from the trade experiences of the advanced countries, to solve nontraditional problems of economic nonviability and social backwardness in the South. The otherwise excellent Vaitsos survey has other weaknesses, the author contends. One consists in its neglect of African and Asian experiences other than those of the East African Common Market. Another perhaps more significant weakness of the survey stems from the lack of equilibrium between the forceful critique of the past integration attempts and the proposals for future action. (MCW)

8364 Case against Torness. *SCRAM Energy Bull.;* No. 5, 2-3(Apr 1978).

Reasons are given for the opposition by the Scottish Campaign to Resist the Atomic Menace to the building of a nuclear power station at Torness (near Dunbar, Scotland). The subject is discussed under the following headings: local employment impact, national employment impact, energy demand, economic aspects, South of Scotland Electricity Board overcapacity, low level waste, high level wastes, reactor safety, the plutonium economy.

8365 Energy as it relates to the quality and style of life. Nader, L.; Beckerman, S. (Univ. of California, Berkeley). *Annu. Rev. Energy;* **3**: 1-28(1978).

This paper is organized around three tasks: (a) to review the literature on the long- and short-term relationships between energy and the quality of life as measured by commonly used indicators such as health, economic well-being, crime and suicide statistics, and general satisfaction; (b) to discuss use of the term life-styles as a prelude to discussing the relation between energy, life-styles, and social organization; and (c) to comment on how such understanding is relevant to the development of energy policies that originate from a user rather than a producer perspective and that are concerned with the purposes for which energy is used to improve the human condition. The first and clearest implication of the research reviewed is that there is no evidence that increasing energy use will increase the quality of American life. Both the global and the restricted perspectives show unambiguously that energy consumption and quality of life vary with substantial indpendence, particularly in the so-called "industrial world." Similarly, energy policy grounded in fear of deleterious change in life-styles and options must be informed by a realization of the very wide range of choice of life-styles that is available in any plausible energy future. Further, it is commonplace that individuals are able to change their life-styles with or without a change in energy policy or even a change in level of energy use. 97 references.

ENVIRONMENT, HEALTH, AND SAFETY

REFER ALSO TO CITATION(S) 7270, 7351, 7445, 8356, 8855, 8869, 8878, 8884

8366 Our hazardous environment. Harriss, R.C. (Langley Research Center, Hampton, VA); Hohenemser, C.; Kates, R.W. *Environment;* **20**: No. 7, 6-15(Sep 1978).

Developing and developed nations alike cope with natural and technological hazards by assessing the costs and benefits and managing the hazards in ways that will minimize the risks. Rural areas and developing nations are most directly affected by natural hazards, while urban areas have replaced many of the geophysical damages with new, more hazardous technological ones at greater social cost. Because the dimensions of technological consequences on human populations and institutions and on both the natural and built environments are difficult to measure, new approaches are used. A two-step system of reviewing mortality statistics, for example, separates genetically and technically preventable deaths to determine the costs of technological mortality. The impact on ecosystems can be assessed by studying species extinction and ecosystem productivity. The author concludes that, while hazard management appears to be having some effect, future efforts must address more of the indirect and broadly distributed impacts. 34 references.

8367 Handling hazards: can hazard management be improved. Fischhoff, B. (Decision Research, Inc., Eugene, OR); Hohenemser, C.; Kasperson, R.E.; Kates, R.W. *Environment;* **20**: No. 7, 16-20, 32-37(Sep 1978).

Hazard management can focus on hazard prevention (as in nuclear safety), on consequence prevention (as in automobile safety), and on consequence mitigation (as in geophysical disaster relief). Based hazard modeling separates hazardous events into initiating events and outcomes, which are further divided into exposure and consequence outcomes. All are connected by pathways where blocking actions can occur. The model is expanded, using pesticides as an illustration of how the causal chain of hazards evolves. Present hazard management is constrained by a lack of complete knowledge of causality, by society's inability to perceive or react to some hazards, and its unwillingness to give up certain benefits. Other constraints involve societal values, institutional weaknesses, and the inherent hazards of controls. To improve hazard management will require a better understanding of the intrinsic risks and benefits of technological change. 22 references.

8368 State of the environment: selected topics, 1978. Tolba, M.K. *Environ. Int.;* **1**: No. 3, 129-140(1978).

Report of the Executive Director, United Nations environment programme, Nairobi, Kenya.

The four topics selected for attention in the 1978 annual report on the state of the environment were chosen on the basis of their international significance and to illustrate how man's activities can degrade the environment. They include: (1) chemicals in the environment, (2) malaria, (3) the use of agricultural and agro-industrial wastes to increase food production, and (4) energy conservation. Each topic is discussed on the basis of resource limitations, environmental damage, and the potential for improving both the environment and human welfare by applying rational standards to resource use. The report covers both beneficial and harmful changes that take place and stresses the need to improve rather than eliminate technology. It recognizes the need to acknowledge a level of risks in order to attain desired benefits. New, ecologically sound ways to kill malaria parasites, for example, must replace the synthetic chemicals which are losing their effectiveness. Better use of organic residue and more efficient use of energy will have both economic and ecological benefits. 75 references.

8369 Environment and development. *Environ. Int.;* **1**: No. 3, 141-146(1978).

Working paper prepared by UNEP Secretariat for an intergovernmental expert group meeting.

Respect for the physical environment and improvements in social institutions are vital to a development of natural resources that is both equitable and sustainable. This requires that environmental considerations be institutionalized in the decision making of developed as well as developing countries and that nations recognize the international impacts of their resource development and life style by making appropriate structural changes in their institutions. The interrelationships of environment and development are considered in terms of the environmental trade-offs required to satisfy human needs and wants. Physically, man's activities degrade the environment and deplete available resources, while socially they affect the quality of life. The idea of planned ecodevelopment is proposed as an improvement over treating the environment as a special problem with the producers paying the costs or as a commodity for which the consumer pays. Ecodevelopment combines sound development strategies with sound ecological use of resources for each region and recognizes that each region is unique. This approach ensures diversity and local participation in planning for production, housing, waste management, pollution control, and other matters.

8370 Protecting visibility: the key to preventing significant deterioration in Western air quality. Tundermann, D.W. (President's Council on Environmental Quality, Washington, DC). *Nat. Resour. Lawyer;* **11**: No. 2, 373-383(1978).

The protection of visibility, including atmospheric discoloration and visual clarity as well as visual range, is now seen to be the key to protecting air quality in the west. Legislation to this end has directed the Environmental Protection Agency and Federal land managers to protect air quality from new emission sources, and to correct existing sources of impairment. Major points of the 1977 Clean Air Act Amendments are examined in terms of scope and scheduling for implementation, which remain unclear. The legislative history of air pollution control is reviewed, and the economic implications of as-yet-unsolved technological requirements are noted.

8371 Management of environmental studies. Roffman,, A.; Roffman, H. (Westinghouse Environmental Systems Dept., Pittsburgh). pp 41-45 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

The management role of an environmental consultant is discussed with regard to identification and understanding of the issues under consideration; interaction and coordination with various governmental agencies; and finalization of the site selection. The following tables are presented: identifying key issues related to air quality; understanding and evaluating issues under consideration; evaluating various modes of action associated with the study; designing the study; and elements associated with the management role of a consultant. (HLW)

8372 Environmental considerations for hazardous waste management facilities. Metry, A.A. (Roy F. Weston, Inc., West Chester, PA). pp 101-106 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Hazardous waste management is now one of the greatest challenges facing environmental engineers and scientists. Fortunately, the long history of inconsistent Hazardous Waste management is being put to an end by new federal legislation, which will establish standards, regulations, and means of enforcement of waste handling and disposal. State agencies will be authorized, and encouraged, to enforce hazardous waste management in their areas. This paper has presented basic criteria and environmental considerations which would be helpful in the planning for construction and design of hazardous waste management facilities.

8373 Methodology for assessing land application of sludges and wastewaters. Chatterjee, S. pp 107-114 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

A simple but innovative methodology has been developed at the Miami Valley Regional Planning Commission to undertake a systematic planning and analysis of land application on a regional scale. The methodology is based on available or computer-coded digitized environmental data base and simplified computer-oriented algorithms to analyze environmental impacts. A complete description of the methodology is presented in this paper. A brief discussion of the analysis and its results are also summarized. The final output is the delineation of environmentally acceptable areas for land application of sludge and/or wastewater. The methodology also allows us to estimate the amount of available land suitable for land application around each wastewater treatment plant within various economic transportation distances, i.e., 5 to 15 miles. It could provide information on land ownership patterns for areas suitable for land application. The information system developed serves as an effective tool for planning, design, environmental assessment, and implementation of areawide land application programs.

ENERGY RESOURCES

REFER ALSO TO CITATION(S) 8349, 8353, 8369, 8435

8374 Future energy sources. Madeley, G.D. (British Gas Corp., London). *Gas Eng. Manage.;* **18**: 262-274(Aug 1978).

Paper presented to the London and Southern Junior Gas Association on 21st October 1977.

Energy-demand projections of 500 to 600 million tons of coal equivalent (mtce) by the year 2000 compared to the supply projec-

tions indicate that the United Kingdom should be able to meet its long-term needs with a combination of coal, nuclear, and renewable sources if these resources are all used conservatively and effectively. The gas industry, for example, foresees a good future in synthetic gases made from coal as a feedstock. The potential for renewable energy sources is reviewed in terms of the present technology and estimated ultimate contribution, with solar and wind energy the major contributors. Biomass is not seen as viable because of land limitations. The combined contribution of all renewable sources is projected at best to be about 200 or less mtce and emphasizes the need for an economical and environmentallly sound way to produce and distribute gas. 27 references.

8375 EPA demonstration projects: a review. *NCRR Bull.;* 8: No. 3, 59-61(Sum 1978).

Government commitments to fund six promising technologies in resource development were made to advance techniques in co-firing, pyrolysis, wet processing, and materials recovery. Of the six, only the fuel for co-firing with coal is complete and only the wet processing for resource recovery is operational. The Resource Recovery Act of 1970 authorized the Environmental Protection Agency to fund innovative, high-risk investments that would have high applicability. A materials recovery project to utilize incinerator residue was not implemented because the project city of Lowell, Mass. felt incinerator costs were too high. Two pyrolysis projects are closed while costly modifications are made. As a risk taker, the Federal government's role can be to cosponsor experiments that will increase knowledge but that may never prove feasible.

8376 Food insecurity: magnitude and remedies. Reutlinger, S. *World Dev.;* 6: No. 6, 797-811(Jun 1978).

Food insecurity is given an operational definition: the probability of food-grain consumption in developing countries falling below a desired level due to a fixed upper limit on the food import bill they can afford, and an unfavorable combination of poor harvests and world food-grain prices. The author argues that food security should not be made contingent upon arrangements for worldwide food-grain supply stabilization. Rather, it is suggested that food security could be attained through a food-import-bill insurance (FIBI) scheme. Alternatively, food security could be attained by a combination of a financial scheme and a grain buffer stock in or on behalf of the developing countries. The paper discusses the specific measures required to implement these proposals and shows that the resource capacity of the international community is sufficient to carry them out.

8377 Land-use planning: attitudes and behavior of elected officials and their constituents. Albrecht, S.L. (Brigham Young Univ., Provo, UT); Geertsen, H.R. *Soc. Sci. Q.;* 59: No. 1, 20-36(Jun 1978).

The relationship between public attitudes and official actions involving controversial land-use issues is examined in a survey of Utah's elected representatives and residents. The study was conducted to determine to what extent elected representatives perceive public opinion and incorporate it into their decision processes. Data sources included a random statewide attitudinal survey, a survey of legislators prior to voting, the actual roll-call vote, and a follow-up statewide survey. While a strong link develops between legislators' perceptions of constituent attitudes and the final vote, other economic and political factors appear to have influence when special interests are involved. Voters were found to have often misread or been ignorant of their representative's vote. These factors, some of which may take precedence over the land-use question at issue, should be incorporated in the model. 18 references.

8378 Long-term energy programme using regenerative sources. Seitz, H. *Mitteilungsbl. Dtsch. Ges. Sonnenenergie;* 3: No. 3, 7-12(May-Jun 1978). (In German).

The present article is a contribution to open up a new perspective of a solar energy concept. First, the different stages of energy consumption are outlined: low-temperature heat, process heat and current, fuels. Possible ways to save energy are also mentioned in these sections. The second part of the paper discusses possibilities of substituting regenerative energy sources, in particular solar energy, for the present primary energy carriers. Also problems of the application of biological energy sources and hydrogen are mentioned. All in all, an optimum utilisation of the available energy requires a close coupling of supply and demand. The article closes on a few examples regarding this subject.

8379 Raw materials policy: implications for Germany. Gaertner, E. *Glueckauf;* 114: No. 7, 313-315(Apr 1978). (In German).

The contribution characterizes the situation of the national mining industry in 1977, deals with international raw materials policies within the framework of the North-South dialogue and with the policies of the western industrial countries, points out the dangers of worldwide state-controlled raw materials policies and calls for a) the political risk of enterprise cooperation with developing countries to be covered and b) double taxation to be avoided. Finally, the problems of securing the Federal Republic of Germany's raw materials supplies on a long-term basis are portrayed.

8380 Resource recovery in Europe. Bidwell, R.; Raymond, K. (Resources Ltd., London). *NCRR Bull.;* 8: No. 1, 3-9(Win 1978).

A status report is given for the resource recovery programs of five members of the European Economic Community (EEC) and two non-EEC countries. The overall approach is examined in terms of institutional framework, specific governmental action, and research and development programs. The immediate goal is a substantial reduction of the 100 million tons of discarded materials that could be recovered each year. Interest in recycling has been prompted by the rising costs of both raw materials and waste disposal and the need to reduce the large volume of waste produced. Tables summarize the government institutions in each country which are responsible for setting resource recovery policy and the enabling legislation, regulations, public education programs, and other actions that are employed. Policies emphasize the economic and environmental advantages of long-term resource and waste management. The report focuses on Denmark, France, Germany, the Netherlands, the United Kingdom, Sweden and Norway. 20 references.

8381 Agriculture in an interdependent world: U.S. and Canadian perspectives. Warley, T.K. (Univ. of Guelph, Ont.). *Look. Ahead Proj. Highlights;* 3: No. 2, 29-31(Win 1977).

The U.S. and Canada need broader agricultural policies that recognize an interdependent world economy and that are compatible with global economics as well as meeting national economic goals. The new position of agriculture in foreign affairs is characterized by the global nature of food problems, which can only be solved by international cooperation. This new interdependence is evident in the political and economic groupings of nations, the importance of U.S. leadership in solving world food-supply problems, and the relationship of the U.S. and Canadian agricultural sectors to world leadership. An emphasis on foreign sales of food since 1972 and the increasing need for better worldwide food distribution have contributed to this new leadership. The General Agreement on Tariffs and Trade approach sets somewhat different priorities than U.S. policy, but this does not warrant overreaction by either the U.S. or Canada. Both the U.S. and Canada will expand their markets in the Soviet Union, but the Canadian Wheat Board uses a centralized grain market approach in contrast to the U.S. system of free markets.

8382 Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State University (1975). 407p. (CONF-7510187—).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Abstracts are prepared for individual chapters. (PCS)

8383 Rice responds to science. Brady, N.C. (International Rice Research Inst., Manila). pp 62-96 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Rice production technology has revolutionized with varieties whose yield potentials double and triple those of traditional tropical rices. Cultural technologies to fully utilize the potential of these rices have also been developed. Original efforts were based on optimum water and nutrient availability but now emphasis is on less favorable soil, water and climatic conditions. International cooperation exists but needs to be encouraged. (PCS)

8384 Agricultural productivity and world nutrition. Mayer, J. (Harvard Univ., Cambridge, MA). pp 97-108 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

For the impending world food crises to be averted, the author offers the following imperatives: (1) Give more prestige and emphasis to agriculture as a profession. (2) Accelerate food preservation research. (3) Educate all countries on need to balance resources and population, through economic, social, and intellectual development. (4) Restructure agricultural development plans to include ecological preservation in addition to social policy which encompasses an employment and salary policy to ensure increased productivity and prosperity. Finally, (5) accept responsibility for a more interdependent world for sharing abundant resources, whether it be oil or food. (PCS)

8385 Shooting at a moving target. Bryson, R.A. (Univ. of Wisconsin, Madison). pp 109-132 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

The economic impact of climate on agricultural productivity is discussed with graphically illustrated history of climatic change during the past 13,000 years. Plant breeding plans must consider less than optimal conditions to feed the world. (PCS)

8386 Nitrogen input. Hardy, R.W.F. (E.I. duPont deNemours and Co., Wilmington, DE); Filner, P.; Hageman, R.H. pp 133-176 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Research imperatives for increasing crop productivity through improved or alternate technologies for nitrogen input are listed as: (1) minimize energy and capital costs of nitrogen fertilizers; (2) develop nitrogen self-sufficiency in crops; (3) maximize efficiency of use of soil nitrogen and fertilizer nitrogen; (4) improve nutritional characteristics of the product; and (5) develop policy on natural gas allocation for fertilizer production and fund a technology center and quality control for N_2-fixing microorganisms. (PCS)

8387 Carbon input. Bukovac, M.J. (Michigan State Univ., East Lansing); Moss, D.N.; Zelitch, I. pp 177-200 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Importance of carbon input to plant production is emphasized. Research imperatives are outlined and discussed. (PCS)

8388 Water, soil, and mineral input. Jackson, W.A. (North Carolina State Univ., Raleigh); Knezek, B.D.; van Schilfgaarde, J. pp 201-274 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

The author urges greater use of existing knowledge rather than expanding basic research for dealing with short term agricultural needs. Interrelationships with soil, water and minerals are discussed with implementation suggestions for optimization efforts. (PCS)

8389 Plant protection from pests. Klassen, W. (Agriculture Research Center, Beltsville, MD); Shay, J.R.; Day, B.; Brown, A.W.A. pp 275-308 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Six broad research imperatives are presented for management of food needs for the next 25 years: (1) research for integrated management systems for stable crop production suited to varied styles of agriculture; (2) research for increased understanding of basic biology of pests; (3) breeding for stable pest resistance; (4) develop biological controls; (5) develop better pesticides and use techniques; (6) innovative approaches for plant protection. (PCS)

8390 Environmental stress. Dilley, D.R. (Michigan State Univ., East Lansing); Heggestad, H.E.; Powers, W.L.; Weiser, C.J. pp 309-355 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Research imperatives are listed for overcoming environmental factors that limit plant productivity. (PCS)

8391 Plant development processes. Adams, M.W. (Michigan State Univ., East Lansing); Carlson, P.S.; Grafius, J.E.; Wallace, D.H. pp 356-375 of Crop productivity: research imperatives. Brown, A.W.A.; Byerly, T.C.; Gibbs, M.; San Pietro, A. (eds.). East Lansing, MI; Michigan State Univ. (1975).

From Conference on crop productivity - research imperatives; Harbor Springs, MI, USA (20 Oct 1975).

Physiological and developmental processes which underlie and determine crop productivity and quality plus the biochemistry and genetics of these processes are discussed. (PCS)

RESEARCH AND DEVELOPMENT

REFER ALSO TO CITATION(S) 8375, 8433

8392 (TID—28503) **Handbook of technology assessment. Final report. Volume I.** Coates, V.T. (George Washington Univ., Washington, DC (USA). School of Engineering and Applied Science). Mar 1978. Contract EG-77-G-01-4040. 108p. Dep. NTIS, PC A06/MF A01.

This analysis examines the need for, desirability of, and justification for government interventions either to stimulate or to control the development of a new technology. The uncertainties involved in such interventions are indicated, as well as societal benefits and costs and an ordered set of alternative or complementary policy options are offered for decision makers together with their long-range implications. Technology assessment (TA) is compared to cost-benefit analysis, systems analysis, operations research, mission analysis, and environmental impact analysis. The components of a comprehensive technology assessment are discussed including: description and forecasts of the technology and of supporting and competing technologies, specification of societal baseline data and alternative future developments, identification of potential impacts, identification of affected parties, evaluation of impacts, identification and analysis of policy issues, identification of appropriate decision-makers, and explication of policy options. Experience in three modes of TA: National Science Foundation, Office of Technology Assessment, and line agency, is described. Guidelines for procurement procedures, requests for proposals, work statements, and project management considerations for successful TA are presented. Some considerations are presented relating to appropriate location of TA activities in line agencies and in the Department of Energy, with specific reference to solar energy technology assessment. (MHR)

8393 Role of industrial R and D in new government programs. Baruch, J.J. (Dept. of Commerce, Washington, DC). *Res. Manage. (N.Y.);* **21**: No. 5, 12-16(Sep 1978).

Dr. Jordan T. Baruch, Assistant Secretary of Commerce for Science and Technology, describes in an interview his views of the cooperative roles of industrial and government research and development. He emphasizes that the government sees industry participation in national programs as appropriate and necessary because the economy is dependent on technological development. The government also recognizes its opportunity to use incentive tools that will influence the private sector. Dr. Baruch suggests that policy changes to reduce investment uncertainties are a major item among the 30 policy areas needing revision. The policy review will cover some 30 agencies and will develop a set of options which industry will be asked to help evaluate. The interview includes a description of the Cooperative Technology Program, which will seek to institutionalize collaboration through infratechnology activities.

8394 System for using R and D project evaluation methods. Souder, W.E. (Univ. of Pittsburgh). *Res. Manage. (N.Y.);* **21**: No. 5, 29-37(Sep 1978).

The author reviews eight characteristic types of models for evaluating projects: index, portfolio, decision theory, risk analysis, frontier, scoring, profile, and checklist. Most are found to be inadequate for organizational decision making because they assume a single decision maker and are limited to one best decision when several may be appropriate. An effective project evaluation model, such as the QS/NI process, must define and agree upon organizational goals and constraints, with all participants able to freely exchange and understand the data as well as the nature of the project so that consensus can be reached. 36 references.

8395 Recent findings regarding the contribution of industrial R and D to economic growth. Terleckyj, N.E. (National Planning Association, Washington, DC). *Look. Ahead Proj. Highlights;* **3**: No. 2, 13-18(Win 1977).

There is new evidence that industrial research and development (R and D) programs have made a significant contribution to economic growth and social welfare. Although a complete synthesis has not been made of the various studies, the accumulated data favors public policies that encourage private investment in R and D. Among the effects are higher productivity and market penetration of new products as a result of improved capital. Difficulties in measuring and evaluating product innovations resulting from publicly financed R and D may explain why it cannot be traced to the same effects. Policies that will maximize the social benefits of private industry R and D should support economic growth and investment in innovation by reducing the costs. This can be done through government co-funding, tap support, direct government participation in competition to industry, and direct subsidy of basic or systems research.

NUCLEAR ENERGY

REFER ALSO TO CITATION(S) 7473, 7491, 7492, 7493, 7494, 7495, 7496, 7514, 7525, 7526, 7961, 7962, 8092, 8101, 8103, 8104, 8105, 8106, 8123

8396 The significance of nuclear exports for the German economy and for the Third World. Barthelt, K. (Kraftwerk Union, Muel-

heim/Ruhr, Ger). *At. Strom;* **24**: No. 1, 1-4(Jan-Feb 1978). (In German).

Important points of view related to energy policy in the FRG which are significant for nuclear export and for the Third World are presented.

8397 Reprocessing the truth. The ecologist analyses the Windscale report. Goldsmith, E.; Bunyard, P.; Hildyard, N. *New Ecol.;* No. 2, 73-80(1978).

Comments are made on the Report by the Inspector, Mr. Justice Parker, after the public inquiry into the application by British Nuclear Fuels Limited for permission to construct and operate a thermal oxide reprocessing plant at their Windscale works. Particular questions raised include: corrosion or storage of spent fuel, vitrification of radioactive waste; radiation effects, and permissible levels; radioactive emissions, critical groups and critical pathways; risks; reprocessing economics; commitment to the FBR; sociological aspects, including employment, nuclear weapon proliferation and terrorism, and Britain's moral responsibilities.

8398 Thoughts on the energy situation. Wideroe, R. (Nussbaumen, Baden, Switz). *Atomkernenergie;* **31**: No. 2, 67-73(1978).

The only possible solution to the energy problem in the long term is breeder reactors, according to the author. The non-proliferation treaty (NPT) is explained, and it is shown that supervision of plutonium production necessary for breeder power plants would be possible. The fusion of deuterium and tritium today still remains a "magic talisman" and will only provide power under economically acceptable conditions after a long development time. 27 refs.

8399 Evolution of the nuclear debate: the role of public participation. Nelkin, D.; Fallows, S. (Cornell Univ., Ithaca, NY). *Annu. Rev. Energy;* **3**: 275-312(1978).

This paper suggests that public opposition to nuclear power also reflects mistrust of government bureaucracies and concern about the extent of citizen participation in policies concerning technology. For many people, nuclear energy development reflects the declining influence of the citizen in important policy areas. Opponents of nuclear power question more than the technology itself: the debate has challenged the nature of the decision-making process concerning large-scale technology as citizen groups demand open access to information and greater public participation. In response to such pressures, government bureaucracies have begun a reevaluation of decision-making procedures, as they grope for ways to reduce conflict, to win public acceptance of energy programs, and, more generally, to renew faith in governmental authority. First, a review of the evolution of conflict over nuclear policies is presented, which suggests the shift from an initial focus on technical problems about the impact of nuclear installations, to a concern with political authority. Following this is an examination of how government agencies have responded to the controversy by groping for ways to broaden public participation. Finally, the problems and limits of this response are suggested. 35 references.

TRANSPORT AND STORAGE

REFER ALSO TO CITATION(S) 8340

8400 (ANL/EES-TM—11) **Transportation of energy materials in the United states.** Emmett, R.C. (Northwestern Univ., Evanston, IL (USA). Transportation Library). Jul 1978. Contract W-31-109-ENG-38. OTp. Dep. NTIS, PC A04/MF A01.

This bibliography lists 459 books, periodical articles, research reports, and conference papers on the transportation of general/multi-fuel, coal, petroleum and gas, nuclear fuel, and electric power. Emphasis is on the various impacts of this transport in the U.S.: environmental, economic, social, safety, policy, etc. Arrangement is by commodity and by mode. An index by type of impact is included.

WASTE HEAT UTILIZATION

REFER ALSO TO CITATION(S) 7344, 7698, 7825, 8495

8401 (COO—4211-3/1) **Grid-connected integrated community energy system. Final report, August 9, 1977—March 22, 1978. Volume I, Phase II.** (Clark Univ., Worcester, MA (USA)). 1978. Contract EC-77-C-02-4211. 41p. Dep. NTIS, PC A03/MF A01.

Clark University represents an attractive site for demonstration of cogeneration. The results of Phase I are briefly reviewed. This report provides an update on issues that were incompletely resolved in the Phase I report. Section 2 provides additional documentation on institutional issues involved in the proposed demonstration. Section 3 provides a preliminary design analysis that clearly defines the choice of engine and provides revised operating data in light of additional load profile studies. It is found that a Sulzer No. 6-oil-burning 1405-kW diesel with ebullient cooling and exhaust-gas heat recovery is the system of choice. Section 4 presents a summary of the preliminary design package. Major items included here, but not previously, are a fuel-treatment facility, preliminary design of a building, preliminary layouts of equipment, including a cooling tower on the roof of an existing building. Section 5 provides a financial analysis based on the design package. In comparison to Phase I, capital costs increased considerably due to the addition of a separate building, fuel treatment, and the use of a more-expensive No. 6-oil-burning engine. It is found, however, that the project continues to be financially viable. Specifically, a 9.4-year-payback period is projected on a total Clark investment of $1.5 million. Total cost, including DOE-financed feasibility studies and demonstration aspects, is projected at $2.2 million. The Clark ICES system is still a generally attractive project. From a national point of view it clearly demonstrates grid-connected cogeneration through the sale of 40% of Clark's output and a net fuel saving of 30%. From Clark's point of view it serves as a sound investment and a useful hedge against inflation and future changes in utility rate structure.

8402 Industrial cogeneration. Williams, R.H. (Princeton Univ., NJ). *Annu. Rev. Energy;* **3**: 313-356(1978).

Technical and economic possibilities for industrial cogeneration are assessed. While cogeneration will probably develop relatively slowly in the period before 1985, Mr. Williams feels that cogeneration could become the major source of new base-load electrical generating capacity in the period beyond 1985. The constraints to this course would be institutional rather than economic, because cogeneration can compete with alternative new sources of base-load generating capacity in a wide range of circumstances. Cogeneration could provide 200 GW(e) of equivalent central station generating capacity and save over 2 million barrels per day of oil equivalent energy by the year 2000 if cogeneration technologies characterized by a high electricity to steam production ratio are emphasized. Because such technologies will usually result in the production of much more electricity than can be consumed at industrial sites, this strategy would be viable only if the present institutional obstacles to the export of electricity from industrial sites can be overcome. Wherever the cost of cogenerated electricity is less than the cost of electricity from new central station plants but greater than the average price of utility generated electricity, utility ownership of onsite generation units appears to be the most promising arrangement. However, wherever the cost of cogenerated electricity is also less than the averageprice of utility electricity, alternative ownership arrangements may also be successful. Some degree of deregulation of power generation via cogeneration is probably crucial to the success of cogeneration development with any ownership arrangement. 46 references.

CONSERVATION

REFER ALSO TO CITATION(S) 8380, 8431

8403 (LBL—7813) **Energy management: a program of energy conservation for the community college facility.** (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1978. Contract W-7405-ENG-48. 101p. Dep. NTIS, PC A06/MF A01.

This handbook developes helps for assessing and improving the energy efficiency of the community-college facility. The TEEM approach (Total Educational Energy Management) is a labor-intensive approach which requires the commitment and participation of all segments of the college community. The TEEM program presented here defines a series of tasks selected, ordered, and implemented in such a way as to achieve two basic objectives: (1) reducing campus energy requirements, and (2) meeting those reduced energy requirements more efficiently without adversely affecting the quality of educational programs. This guide to large-scale energy conservation on college campuses includes step-by-step procedures for establishing a program task force, defining specific tasks, and assigning responsibilities. Action plans are developed, energy consumption monitored, goals set, and conservation measures implemented. A series of appendices provides more detailed information, charts, and worksheets related to all aspects of energy use. The TEEM program provides the basic structure for achieving a significant reduction in campus energy costs.

8404 (ORNL/CON—26) **ACES demonstration: construction, startup, and performance report.** Holman, A.S.; Brantley, V.R. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 86p. Dep. NTIS, PC A05/MF A01.

A 2000-ft² single-family residence was constructed during the second quarter of 1976 to demonstrate the energy-conserving features of additional insulation, a ventilation cooling cycle, and the Annual Cycle Energy System (ACES). The ACES is an integrated

heating and cooling system that supplies space heating, hot water, and space cooling using a heat pump and low-temperature thermal storage. Included in this report are a discussion of the construction techniques employed and the problems encountered during construction, a description of the ACES concept and the ACES mechanical package, and a discussion of the ACES performance and the experiences obtained during initial operation of the ACES. Continuous operation and data collection were begun in May 1977. Performance data from November 1977 through March 1978 have shown a seasonal heating coefficient of performance of 2.77 for the ACES, giving a 63% energy reduction compared to electric resistance space and water heating.

8405 (ORNL/CON—31) **Regional analysis of residential water heating options: energy use and economics.** O'Neal, D.; Carney, J.; Hirst, E. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 64p. Dep. NTIS, PC A04/MF A01.

This report evaluates the energy and direct economic effects of introducing improved electric-water-heating systems to the residential market. These systems are: electric heat pumps offered in 1981, solar systems offered in 1977, and solar systems offered in 1977 with a Federal tax credit in effect from 1977 through 1984. The ORNL residential energy model is used to calculate energy savings by type of fuel for each system in each of the ten Federal regions and for the nation as a whole for each year between 1977 and 2000. Changes in annual fuel bills and capital costs for water heaters are also computed at the same level of detail. Model results suggest that heat-pump water heaters are likely to offer much larger energy and economic benefits than will solar systems, even with tax credits. This is because heat pumps provide about the same savings in electricity for water heating (about half) at a much lower capital cost ($700 to $2000) than do solar systems. However, these results are based on highly uncertain estimates of future performance and cost characteristics for both heat pump and solar systems. The cumulative national energy saving by the year 2000 due to commercialization of heat-pump water heaters in 1981 is estimated to be 1.5 QBtu. Solar-energy benefits are about half this much without tax credits and two-thirds as much with tax credits. The net economic benefit to households of heat-pump water heaters (present worth of fuel bill reductions less the present worth of extra costs for more-efficient systems) is estimated to be $640 million. Again, the solar benefits are much less.

8406 **Can the regulations under the Energy Conservation Act be met with present-day heating equipment.** Holler, K.F. *Gas Waerme Int.;* **27**: No. 5/6, 259-267(May-Jun 1978). (In German).

The regulations under the energy conservation act contained in the future ordinance on heating installations and their operation were passed by the Federal cabinet on March 24, 1977, but their modified version will presumably not become effective before the end of 1978 for a variety of reasons. The new regulations are of considerable importance for manufacturers of equipment, planners, heating system engineers, owners or users. The author has examined these regulations for their aims and enforceability on the basis of a nation-wide measuring scheme carried out in 1977 for the Federal Ministry for Regional Planning, Civil Engineering and Urban Development. The relevant regulations are compiled in tabulated form and the results from measurements are compared with the future requirements in graphs.

8407 **Industry saves energy: progress report, 1977.** Whiting, M. (Dow Chemical Co., Midland, MI). *Annu. Rev. Energy;* **3**: 181-199(1978).

This is primarily a progress report on the development of a more energy-efficient industrial complex in the United States. The report begins with an overview of industrial use of energy in 1977 and the environment in which it existed. Governmental developments occupy a central position in this section. The report goes on to consider examples of projects for the improvement of energy efficiency in a number of industries, specifically, the glass, paper, chemical, cement, food, and steel industries. Then, following a short section on the overwhelming influence of the stock of energy-using plant and equipment on industrial energy consumption, the report presents some information that has been published in the committee on Nuclear and Alternative Energy Systems report of the National Academy of Sciences. This report focuses on the supply of and demand for energy in the year 2010. This report covers some of the conclusions of CONAES Demand/Conservation Panel and its Industry Resource Group. Particularly surprising are their findings regarding the large potential for energy conservation. This potential for energy conservation by industry is elaborated in the next section and some of the most important strategies and their necessary developments are discussed. In conclusion, additional examples of needed developments, both technical and nontechnical, are discussed. 7 references.

8408 **Aggregate energy, efficiency, and productivity measurement.** Berndt, E.R. (Massachusetts Inst. of Tech., Cambridge). *Annu. Rev. Energy;* **3**: 225-273(1978).

This paper provides a framework within which alternative-energy-productivity measures can be analyzed and interpreted. In the first section the author considers thermodynamic and economic foundations, and discusses economic implications of Second Law efficiency measures. In the third section he considers the assumptions implicit in aggregate Btu measurement, and proposes an alternative indexing procedure more consistent with economic theory. The fourth section provides a brief historical survey of several major aggregate average energy productivity studies and then goes on to a discussion of the economic theory underlying average input and total factor productivity. The elasticity of average productivity is shown to be the negative of the economist's traditional price elasticity of demand. In the fifth section, recent econometric evidence bearing on the quantitative magnitudes of factors affecting productivity movements is surveyed. The final section concludes and summarizes. 65 references.

8409 **Department of Army publishes new energy plan.** *Army RD and A;* **19**: No. 3, 8(1978).

Relative to the Department of Defense, the National Energy Plan states that the DOD consumes 1.9% of the nation's energy but consumes more than 3% of the total petroleum used by the U.S. The Army's portion of DOD energy consumption is 18% and, of that amount, 84% is consumed in installation or facilities operations and 16% in mobility operations. The Army energy plan identifies the following objectives and goals: reduce energy consumption by 45% by the year 2000; reduce consumption in facilities operations by 25% by FY85 and 50% by the year 2000; expand conservation education/information and incentive programs for all military and civilian personnel and dependents; reduce dependence on non-renewable and scarce fuels by the year 2000; eliminate use of natural gas and reduce use of petroleum fuels in facilities operations by 75% by the year 2000; convert 20% of mobility operations petroleum requirements to synthetic or alternate fuels by the year 2000; increase efficiency of nonrenewable energy dependent mobility systems by 15% with no degradation to readiness; and attain a position of leadership in pursuit of national energy goals. If the Army is successful in meeting its newly adopted goals of reducing overall energy consumption by 45%, states the energy plan, the costs are expected to be $1.8 billion in FY2000, resulting in a cost avoidance of $1.3 billion. In order to meet its long term energy conservation goals, the Army is placing specific emphasis in the areas of installation operations, mobility operations, training, and research and development. A summary of current and proposed activities in each of these areas is given.

SUPPLY, DEMAND, AND FORECASTING

REFER ALSO TO CITATION(S) 8374, 8413, 8424, 8434

8410 **Bilans energetiques des pays de l'OCDE, 1973-1975. (Energy balances of OECD countries, 1973-1975).** Paris, France; OCDE (1977). 129p. (In English and French).

Analysis of energy problems requires a comprehensive presentation of basic statistics in original units such as tons of coal and kilowatt hours of electricity. The usefulness of such basic data, can be considerably improved by expressing them in a single common unit suitable for uses such as estimation of total energy requirements, forecasting and the study of substitution and conservation. The first major attempt by the OECD to meet such requirements was the publication of Energy Balances of OECD Countries 1960/1974 in April 1976. This provided standardized energy balance sheets expressed in a common unit of tons of oil equivalent for all OECD countries. The energy balances in the present volume for the years 1973-1975, are based on data recently published in 'Energy Statistics 1973-1975'. The only exception is 'non-commercial fuels' which come from national sources. The methodology used is essentially the same as that used in producing the first volume, but some minor changes have been made to accomodate revisions in the content and presentation of the basic statistics and to provide more detail on final consumption by sector. The approach adopted in converting the basic data to a common unit is that sometimes known as a 'partial substitution model'. In this model coal and gas are expressed in terms of the quantity of oil which gives the same amount of heat, whereas hydro and nuclear electricity are expressed in terms of the hypothetical amount of oil which would be needed to produce the same amount of electricity in existing conventional thermal power plants .

8411 **How much energy do we really need.** Mottley, C.M. (Energy Research and Development Administration, Washington, DC). pp 1-22 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

The energy needs of the US to the year 2005 are evaluated on a requirements approach, which is offered as a way to establish strategic objectives. The rationale for estimating the total or aggregate national energy requirements are presented. The rationale is then used to frame quantitative energy target areas. The effect of conservation on employment is also examined. (JSR)

POLICY, LEGISLATION, AND REGULATION

REFER ALSO TO CITATION(S) 8377, 8392, 8393, 8395, 8396, 8406, 8420, 8425, 8434

8412 (ALO—10) **Table of cases decided in the United States Court of Claims: 1863—1975.** Gallegos, E.R. (comp.). (Department of Energy, Albuquerque, NM (USA). Albuquerque Operations Office). 1975. 331p. Dep. NTIS, PC A15/MF A01.

This Table of Cases is a compilation odf the decisions pertaining to each claim decided by the United States Court of Claims since its inception (together with any subsequent orders, judgment orders, judgments rendered without opinions, and Supreme Court decisions) as published in the following publications: Court of Claims Reporter (1863 to 1975); Federal Reporter (2d) (1930 to 1932, 1960 to 1975); and Federal Supplement (1933 to 1960). Court of Claims decisions were not published in the Federal Reporter prior to 1930, nor were they included in this publication during the period 1933 to 1960.

8413 **Community's energy policy: four years later.** Rehert, K. *Glueckauf;* **114**: No. 4, 182-186(Feb 1978). (In German).

The Council of the European Community adapted in December 1974 energy EC Commission was asked to compare these aims regularly with forecasts and energy programs developed on national levels, in order to assess to what extent the EC objectives had materialized. The article analyzes and discusses results contained in the 2nd report of the EC Commission presented in the summer of 1977 and names the consequences drawn by the EC Commission (GG).

FOSSIL FUELS

REFER ALSO TO CITATION(S) 7323, 7328

8414 (TID—28463) **Fundamental characterization of alternate fuel effects in continuous combustion systems. Technical progress report No. 1, August 15, 1977—August 14, 1978.** Blazowski, W.S. (Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.). 11 Jan 1978. Contract EC-77-C-03-1543. 144p. Dep. NTIS, PC A07/MF A01.

The properties of alternate fuels derived from coal, oil shale, and tar sands can result in significantly different combustion performance compared with conventional specification fuels. For example, decreased hydrogen content can result in increased flame luminosity and exhaust smoke emissions, higher fuel bound nitrogen can result in increased NO/sub x/ emissions, and fuel impurities can result in deposition within the combustion device. Although additional refining and fuel treatment can mitigate these problems to some extent, the approach of adapting the combustion system to utilize fuels having "unconventional" properties while operating in an environmentally acceptable manner seems to be most cost effective and energy efficient. This program will provide fundamental information necessary for the efficient pursuit of this approach. The work will be limited to investigation of alternate liquid and gaseous fuels used in continuous combustion systems, with gas turbine systems receiving special attention. The program philosophy is to relate fundamental combustion phenomena to fuel characteristics using analytical models developed with and eventually verified by data obtained in carefully designed experiments. Key combustion properties and ranges of fuel variation of interest to subsequent efforts have been surveyed. Recently initiated experimental work includes the utilization of unique ER and E experimental euipment for evaluation of fuel combustion characteristics. The analytical modeling effort includes new modeling techniques as well as predictions of and comparisons with the experimental results generated. This report is intended to provide background information on the current understanding of alternate fuel efforts in gas turbines. The key technical areas requiring additional study and analysis are identified and prioritized. Current plans for experimental study of the highest priority problem, soot formation, will be briefly reviewed.

8415 **Estimates of fossil-fuel resources. 2. Possible levels of production.** Grenon, M. *Rev. Energ.;* **29**: No. 302, 146-154(Mar 1978). (In French).

It is estimated that the level of coal production in the world will rise from about 2.7 Gtec at present to 8.7 Gtec in the year 2020, i.e. it will show an average annual rate of increase of 2.6% between 1975 and 2020. Three scenarios for the future production of oil are discussed depending on the availability of recoverable reserves. They indicate that the maximum level of oil output will be attained sometime between 1985 and 1995. The maximum level of natural gas output is expected to be attained about the year 2005 (about 16.50 Gtec). This hypothesis assumes the production of unconventional hydrocarbons starting from about the year 1990 and reaching about 4.40 Gtec (or about 3 Gt of oil equivalent) by the year 2020. Distribution of output of various resources by countries is given in tables.

COAL

REFER ALSO TO CITATION(S) 7270, 7279, 7287, 7322, 8379, 8423

8416 **Scaling-up coal liquids.** *EPRI J.;* **3**: No. 7, 6-12(Sep 1978).

The electric utilities will offer a large coal liquids market if processes can be increased from the present small-scale demonstration stage to a commercial volume. Cost projections for demonstration plants and commercial facilities are about $12 billion for an estimated 450,000 barrels per day production by 1990. The production of synthetic oil from coal would be consistent with the national goal of using more coal and less imported oil, while enabling utilities with large investments in oil-fired facilities to save the costs of conversion to direct coal burning. Coal liquids, to be used by the utilities, must be economically competitive with other fuels by the time they are needed. Utilities favor three coal liquefaction processes (SRC-II, H-Coal, and EDS), which are all at comparable levels of development. Scale-up programs that include demonstration plants for each process will be very costly, but the simultaneous development approach lessens the risk of not having a process ready when it is needed.

PETROLEUM

REFER ALSO TO CITATION(S) 7326, 7329, 7330, 7331, 7351, 8352

8417 **Expanded drilling won't solve the energy dilemma.** North, F.K. (Carleton Univ., Ottawa). *World Oil;* **187**: No. 5, 133-134, 136, 138(Oct 1978).

The author postulates that there is absolutely nothing that can be done by the domestic oil and gas industries of the United States and Canada that will have any discernible impact on the oil supply of the two countries and that the respective governments and industries should turn their attention to alternate sources, and quickly. The reason for this projection: a notable lack of major oil fields (there probably are none) with sufficient reserves to arrest the decline of current production. He discusses specific reasons for his forecast. (MCW)

8418 **Major results in consumption developments of petroleum products and their supplies in West Germany, 1973—77.** *OAPEC News Bull.;* **4**: No. 10, 11-15(Oct 1978).

A study of market development and petroleum consumption trends in West Germany is the first in a series of studies to be made on each Western industrialized country. The growth rate of petroleum-product consumption has declined since peaking in 1973, and is not expected to regain the previous level until after 1980. Both imports and exports declined in 1977, leaving net imports the same (about two percent growth) in spite of a 13-million-ton drop in consumption. Statistics show that German refineries depend on imported crude for production needs, which is reflected in product price increases.

8419 **Marker and the market, the heavy and the light.** Mabro, R. (St. Antony's Coll., Oxford). *OAPEC News Bull.;* **4**: No. 10, 25-33(Oct 1978).

The argument is made that Saudi Arabia's decision to restrict exports of light crude oil could ultimately increase total petroleum exports because the policy speaks to the composition and not the level of export. The market implications of this policy are examined in terms of motivation and the export mix of heavy and light crude under conditions of both surplus supplies and scarcity. Conservation of light oils and expansion of domestic heavy oil production are seen as goals, which are politically acceptable to world markets and are helpful to the Organization of Petroleum Exporting Countries partners.

8420 **Outcome of the December 1977 OPEC conference in Caracas and possible repercussions on oil markets. From the OPEC conference in Stockholm mid-1977 to the OPEC conference in Caracas at the end of 1977.** Rummert, H.J. *Glueckauf;* **114**: No. 4, 186-189(Feb 1978). (In German).

The following is reported on: the oil price policies of the OPEC countries from the OPEC conference in Stockholm in 1977 up to the Caracas conference at the end of 1977, the results of the

conference at Caracas, the background for the resolutions taken and their possible repercussions on the oil markets.

NATURAL GAS

REFER ALSO TO CITATION(S) 7351, 7364, 7365, 7366, 7367, 7368, 7414, 8417

8421 Australia's NW Shelf: gas is the current attraction. Thomas, J.S.; Nestvold, E.O.; Crostella, A. (Woodside Petroleum Development Pty. Ltd., Perth, Australia). *World Oil;* **187**: No. 5, 141, 143, 147, 151, 154(Oct 1978).

Three major gas discoveries have been made and an active exploration program is underway off the northwest coast of Australia. Plans are underway for a major feasibility study on development of the Goodwyn, North Rankin, and Angel gas finds, three of a number that have been recorded in the area. If reasonably stable political and economic conditions are maintained, development of these fields is likely and the area could be a major gas producer by the 1980s. General geology of the area has been worked out, although many problems associated with details of structure and lithostratigraphy remain to be solved. Gas has also been found on the Scott Reef high trend. This reef is associated with a surface reef as Boutakoff orginally suggested, but other high trends have no surface expression and wells on other reefs have been disappointing. Wells have also been drilled on the original Woodside permit, with some major finds. Minor oil discoveries were made in other wells. This article presents information on this recent exploration and drilling activity on the Northwest Shelf, and discusses regional geology with emphasis on stratigraphy.

OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 7445, 8423

8422 Economic feasibility of shale oil: an activity analysis. Ericsson, N.R. (London School of Economics and Political Science); Morgan, P. *Bell J. Econ.;* **9**: No. 2, 457-487(Aut 1978).

Given the current state of technology, the existing resource supplies, and environmental constraints, the authors examine how much shale oil could be profitably produced in the Western United States, what processes would be used, and which constraints would be binding in long-run equilibrium. Using an activity analysis model, they show that production of over 15 million barrels of shale oil per day (five-sixths of present U.S. oil consumption) is a profitable activity when the price of oil is only $18 per barrel (1975 dollars). In testing the sensitivity of the results, they find that, even under quite conservative assumptions, production of two million barrels per day is economically feasible in the long run when the selling price of oil exceeds $12 per barrel. 41 references.

HYDROGEN AND SYNTHETIC FUELS

REFER ALSO TO CITATION(S) 7539, 7605, 8414, 8416

8423 (UCRL—13886(Pt.2)) **Economics and modeling of manufacture and automotive use of broad-cut fuels from coal and shale syncrudes.** Moore, M.A.; Short, W.D. (SRI International, Menlo Park, CA (USA)). Aug 1978. Contract W-7405-ENG-48. 40p. Dep. NTIS, PC A03/MF A01.

SRI has developed the pertinent economic and efficiency data on the manufacture, distribution, and end-use of broad-cut fuels (BCF) for automotive transportation. This study defines the economic parameters of refining BCF from syncrude and chooses an appropriate modeling approach to represent this potential fuel option for transportation. A number of engines have been developed that can use wide boiling range fuels (BCF) without the octane, cetane, and other qualities now required in gasoline and diesel fuels. For this study, Texaco's design for a direct-injected stratified charge (DISC) engine has been selected to represent the generic class of BCF engines. This engine's technology will allow considerable simplification of the refinery processing required for automotive fuel, with corresponding reductions in refinery energy requirements and operating costs. The BCF under consideration is envisioned to be a mixture of hydrocarbons in the nominal distillation temperature range of 100 to 650°F. Many conventional petroleum products, including gasoline, kerosene, and diesel fuel, lie within this boiling range. Once separated from the syncrude mixture, the BCF fraction is conceived to require no additional processing other than hydrotreating to remove sulfur, nitrogen, and oxygen heteroatoms remaining from the syncrude upgrading stage. Thus, the refinery process required for this minimal chemical modification of the syncrude product could be as simple as a conventional atmospheric distillation step followed by hydrotreating of the 650°F and lighter fractions.

ELECTRIC POWER

REFER ALSO TO CITATION(S) 8354

8424 (CONF-780802—9) **Study of electricity demand and variation in the price elasticity of demand for manufacturing industries.** Chang, H.S.; Chern, W.S. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 8p. Dep. NTIS, PC A02/MF A01.

From American Statistical Association meeting; San Diego, CA, USA (14 Aug 1978).

A dynamic demand equation and a quadratic price equation for electricity are specified and estimated simultaneously by the 3SLS method for each of 15 SIC three-digit manufacturing industries. Results show that estimated coefficients are mostly significant and have correct signs, that there are substantial interfuel substitutions in manufacturing industries, and that the estimated price elasticities of demand, the coefficients of adjustment, and the elasticities of demand with respect to the value added all vary greatly among industries. An interesting result is obtained from the analysis on the variation in the price elasticities of demand among industries. The short-run price elasticity in absolute value is found to be positively related to the electricity intensiveness, the price of electricity, and the coefficient of adjustment, while it is negatively related to the elasticity of demand with respect to the value added. The findings on the variation in the price elasticity are discussed. (1) A rise in electricity price will reduce the industrial demand for electricity not only because quantity demanded and price are negatively related, but also because a higher price will make industries more responsive to the increase in price. (2) A high-price policy to conserve electricity is more effective for industries like SIC 262, 263, and 333 because they are more electricity-intensive than other industries like SIC 203, 371, and 225. (3) To those industries that use electricity more as an indirect input, a price policy should be more effective than to those industries that use electricity more as a direct input. (4) Some industries (e.g., SIC 263, 371, and 281A) react more quickly to changes in factors affecting the costs than others (e.g., SIC 204, 291, and 331); hence their demand for electricity is more responsive to changes in the price. 22 references.

8425 Hybrid DOE office focuses on utilities. *EPRI J.;* **3**: No. 7, 32-35(Sep 1978).

The Office of Utility Systems (OUS), a coalition of formerly separate agencies in the new DOE, provides expertise on utility operations so that research and development funding will be realistic. Its limited regulatory function is geared to issues of customer demand and to promoting local initiatives that are consistent with national policy, such as rate design and load management projects. The group focuses on joint government and industry efforts to achieve systems reliability, economy, and service efficiency. A third activity is that of intervention as an advocate on behalf of DOE policy.

8426 Toward optimal capacity expansion for an electric utility: the case of Saskatchewan Power. Rowse, J. (Queen's Univ., Kingston, Ont.). *Can. J. Econ.;* **11**: No. 3, 447-469(Aug 1978).

The usefulness of mathematical programming models in assisting to solve capacity-expansion problems in the electric power sector has increasingly been demonstrated. To date, however, little emphasis has been placed upon using the capabilities of these same models to investigate questions of economic and public policy concern that inevitably are associated with the issue of capacity expansion. This paper illustrates how one mathematical-optimization technique, namely mixed-integer programming, can be applied to the expansion problem of a specific electric utility, namely the Saskatchewan Power Corporation, to examine the cost and supply consequences of excluding from consideration particular investment alternatives possessing undesirable externalities and of employing policies that successfully reduce demand growth or smooth the variability of power demand. 16 references.

ELECTRIC POWER GENERATION

8427 (DOE/EIA—0048/1) **Gas-turbine electric plant construction cost and annual production expenses, 1974: second annual report.** (Department of Energy, Washington, DC (USA). Energy Information Administration). May 1978. 121p. Dep. NTIS, PC A06/MF A01.

A total of 491 gas-turbine electric plants owned and operated by electric utilities in the United States produced 32.114 billion kWh during calendar year 1974, slightly more than the net 1973 production of 29.456 billion kWh. The installed capacity of these gas turbine electric plants at the end of 1974 was 39,502 MW, up 19.6 percent from the 33,036 MW in 1973. The total installed capacity of the 342 gas-turbine electric plants (10 MW or larger) in the U.S. included in this report was 34,171 MW at the end of 1974, and their net generation for that year totaled 27.287 billion kWh. These plants

account for approximately 86.5 percent of the total installed gas-turbine electric plant capacity and 85.0 percent of the net gas-turbine generation in 1974. Generation and capacity of all gas-turbine electric plants, and of the larger plants listed in this report, are shown. The plant data sheets show construction costs, production expenses, generating equipment characteristics and other relevant statistical information for each of the 342 plants.

8428 Small hydro project potential at existing dams. Janopaul, R.N.; Willer, D.C. (Tudor Engineering Co., San Francisco). *Mil. Eng.;* **70**: No. 457, 318-322(1978).

A recent Corps of Engineers study found that of the 50,000 dams in this country, only 800 are being used to produce electrical energy. Some of these 50,000 dams once produced power, but as the initial equipment wore out and alternative sources of electrical energy became cheaper, it was not economically feasible to refurbish them. The Corps believes that if all of the dams which could produce power were reactivated, or if new generating capacity were installed, they could supply a total of 54,600,000 kW and generate almost 160 billion kWh. It would take 265 million barrels of oil each year to generate that amount of power. The total energy shortage can never be solved with these small hydro projects. More massive projects are needed. However, many cities and public utilities could install some generating units at existing dams and produce energy at less cost than that of alternatives. These are the advantages: the natural resource is already there, and it is a renewable one. There is usually no environmental impact--no air or water pollution. And the process is clean, quiet, small scale, and unobtrusive, and frequently takes place near a population center, eliminating the need for long or high-voltage transmission lines. Technology of generating hydroelectricity exists, and in highly sophisticated form. For small hydroelectric projects at existing dams, generation can easily be achieved in five years from the conception date.

CONSUMPTION AND UTILIZATION

REFER ALSO TO CITATION(S) 8357, 8358, 8365, 8409

8429 (BNL—24708) **Fleet operator study: geographic aspects.** Wagner, J.R.; Naughton, J. (Brookhaven National Lab., Upton, NY (USA)). Jul 1978. Contract EY-76-C-02-0016. 18p. Dep. NTIS, PC A02/MF A01.

The National Center for Analysis of Energy Systems at BNL is currently performing a study of light-duty highway fleets (i.e., passenger cars and light trucks). In this context, "fleets" refers to vehicles that are owned and/or operated by businesses, state governments, or local governments. The study has three basic objectives: (1) development of a statistical profile of fleet vehicles, and identification factors affecting technological penetration rates; (2) development of a systematic framework for estimating the rate at which new technologies can penetrate the fleet-vehicle market; and (3) generation of a formal set of scenarios to illustrate the relationships between technological options, the requirements of fleet vehicles, and technological penetration rates. Pursuit of the first objective has resulted in compilation of the BNL Fleet Vehicle Data Base. The data base consists of survey data collected in August to September, 1977. Questionnaires were sent to 10,774 USA fleet operators; 1,147 responded, representing a total of 362,205 vehicles. The questionnaire was primarily designed to collect data on the types of vehicle missions that fleet vehicles must fulfill. This report is a preliminary description and analysis of the regional characteristics of the data base.

8430 International variations in energy use: findings from a comparative study. Darmstadter, J.; Dunkerley, J.; Alterman, J. (Resources for the Future, Washington, DC). *Annu. Rev. Energy;* **3**: 201-224(1978).

This article deals with the frequently posed question as to why per capita consumption of primary energy resources is so much higher in the U.S. than it is in other advanced industrial countries whose per capita income does not differ appreciably. President Carter's National Energy Plan, for example, referred to the greater U.S. use of energy per dollar of gross national product compared with any other industrialized nation and alludes to the fact that the possibility indeed exists that the American standards of living can be maintained at a much lower level of energy use. Such a finding could have major significance for the direction and eventual payoff from conservation strategies that the United States might see fit to undertake. This article provides a first step toward discussing this issue. Growing out of research conducted by Resources for the Future over the past several years, it is a quantitative reconnaisance depicting the comparative patterns of energy consumption in 1972 for nine countries considered to have high incomes by international standards. These countries are: U.S., Canada, France, W. Germany, Italy, Netherlands, U.K., Sweden, and Japan. Further, those components of energy consumption are identified that give rise to variations between countries in the relationship between energy use and national output. Finally, as far as possible, the respective contributions of (a) economic structure, and (b) characteristics of energy utilization, to the intercountry variations in energy and output are interpreted. Where the data permit, underlying factors--such as relative price differences and demographic features--are woven into the analysis. Four major sectors--industrial, transformation losses, household-commercial, and transport--are considered and compared. (MCW)

8431 (TID—28398) **Report of the proceedings of the Department of Energy workshop on energy conservation in the food processing industry, October 6 and 7, 1977.** D'Angelo, S. (ed.). (Washington Scientific Marketing, Inc., DC (USA)). 1977. Contract W-31-109-ENG-38. 94p. Dep. NTIS, PC A05/MF A01.

This second workshop on food processing identifies the opportunities for energy conservation and establishes R, D, and D needs in the industry. Eight working groups (bakery products, dairy, fats and oils, fruits and vegetables, grain, malted beverages, meats, sugar) made recommendations broadly classified into 4 categories: systems studies, process modifications, heat recovery technology, and technology transfer. The workshop participants expressed a concern for the impact of government regulations on energy consumption rates. Several system studies were recommended to quantify the increment of energy input necessitated by government regulations. The workshop participants believe that modifications based on these studies can conserve considerable quantities of energy. Six of the eight working groups were highly interested in the development of efficient drying technology. The development of reverse osmosis membranes applicable in distinct working conditions (e.g. temperature, pH level) was recommended by three groups. A great interest was shown also in applications of co-generation and in efficient use of energy in sanitation operations. Federal coal-conversion regulations have engendered a great interest in the development of coal gasification and coal combustion technology. A great interest was shown also in applications of co-generation and in efficient use of energy in sanitation operations. Federal coal-conversion regulations have engendered a great interest in the development of coal gasification and coal combustion technology. All of the industries present have ascertained the need for heat-recovery technologies. (MCW)

8432 Successful transportation system and the regional planning problem: an evaluation of the Munich rapid transit system in the context of urban and regional planning policy. Kreibich, V. (Univ. of Dortmund, Ger.). *Transportation;* **7**: No. 2, 137-145(Jun 1978).

The development of the Munich Rapid-Transit System, coupled with the growth of the Munich region, has had a major effect on the spatial structure of the region. The radial form of the rapid-transit system has led to an outward movement of higher-income families and a strengthening of the service function of the city center, to the cost of local centers. Lower-income families are tending to settle in the city-center fringe areas, although their primary employment opportunities, in the manufacturing industry, are increasingly moving to the urban fringe. There is, thus, a growing spatial separation between homes and workplaces and, although the rapid-transit system has reduced traffic congestion in Munich, it has encouraged the development of an urban structure that is not compatible with the objectives of either the state or the region.

UNCONVENTIONAL SOURCES AND POWER GENERATION

REFER ALSO TO CITATION(S) 8374

8433 Alternative energy in the USSR. Gruenbaum, R. *Environment;* **20**: No. 7, 25-30(Sep 1978).

Although renewable energy sources have a relatively low priority in the resource-rich Soviet Union, research and development in new energy-conversion systems will be expanded to exploit wind and solar energy. Wind research projects will include desalination and pumping water, cathodic protection of pipelines, and large-scale power generation. Solar projects will include desert irrigation, solar-powered houses and appliances, and pulsed solar irradiation. In addition, tidal power plants are being installed along the coasts and geothermal plants for both power generation and local heating will operate at several sites. 22 references.

8434 Soft energy technologies. Lovins, A.B. (Friends of the Earth, Inc., London). *Annu. Rev. Energy;* **3**: 477-517(1978).

The hard and soft energy paths are compared. The soft path for the U.S. combines greatly increased efficiency in using energy, including transitional fossil fuels, with the rapid introduction of "soft technologies." These, the subject of this paper, are defined as diverse

renewable sources relatively simple from the user's point of view (though often technically very sophisticated) and matched in scale and in energy quality to the range of end-use needs. Craig et al. have also suggested further criteria--soft technologies are environmentally benign, subject to "graceful failure," foolproof (or resilient), and flexible--but these descriptions, though accurate, are probably derivative rather than essential to the definition. Mr. Lovins feels that a sound energy policy emphasizes the sustainable direct supply and efficient use of heat for buildings and processes and of liquid fuels for transportation, not further central electrification. A wide range of relatively simple-to-use renewable energy sources matched in scale and in energy quality to our range of end-use needs is now available at attractive marginal costs, he states. Such soft technologies appear able to make a prompt and major contribution to energy supply compared to alternative investments in central-electric systems, synfuel plants, and other centralized devices to convert depletable fuels to premium energy forms.The former technologies appear superior to the latter in costs, rates, geopolitical implications (including nuclear proliferation), and domestic sociopolitical implications (perhaps the key policy determinant). Soft technologies are increasingly being used in practice, to construct smooth transitions (over 50 years or so) to virtually complete reliance on appropriate renewable sources, meanwhile using fossil fuels far more efficiently and cleanly in transitional systems adaptable to soft sources as they are installed. 173 references. (MCW)

SOLAR

REFER ALSO TO CITATION(S) 7704, 7731, 7733, 7761, 7771

GEOTHERMAL

8435 Integrating energy development and land management goals in the national forests; or how geothermal resources got lost in the woods. McNamara, J. (Univ. of Southern California, Los Angeles). *Nat. Resour. Lawyer;* **11**: No. 2, 325-341(1978).

The resource potential of geothermal resources is estimated to require only ten 110-MW power plants to save 13 million barrels of imported oil a year; and, theoretically, to be ultimately capable of meeting up to half the national demand provided institutional and legal barriers can be overcome. Federal taxes and land-management policies are identified as the major problems. The background of how these policies developed and their constraints on geothermal-resource development are reviewed and several possible solutions proposed. These include repeal or amendment of the Geothermal Steam Act to regard geothermal resources as water rather than mineral and amendment of the Wilderness Act. These legislative actions would open the national forest system to exploration and assessment of geothermal resource potential.

OTHER

REFER ALSO TO CITATION(S) 7599, 7600, 7601, 7602, 7603, 7604, 7606, 7641, 7642, 7643, 7644, 7645, 7646, 7647, 7648, 7908

8436 Uncounted energy: the present contribution of renewable resources. Tillman, D.A. (Materials Associates, Washington, DC). pp 23-54 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

In order to examine the contribution of nonfossil energy resources, a cursory survey is made of the historical antecedents of renewable energy resource use. A detailed examination is then made of the present contribution of silvicultural, agricultural, and urban residues and fuels. Trends and forces associated with the use of renewable resources are documented. From these data conclusions are drawn.

8437 Anticipated competition for available wood fuels in the United States. Grantham, J.B. (Pacific Northwest Forest and Range Experiment Station, Seattle). pp 55-91 of Fuels and energy from renewable resources. Tillman, D.A.; Sarkanen, K.V.; Anderson, L.L. (eds.). New York; Academic Press, Inc. (1977).

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

An overview is presented of the competition that may develop for wood as an energy source vs. its use as an industrial raw fiber. Competition is anticipated in filling future fuel and fiber needs from unused wood residues or from unmerchantable timber and the output of energy plantations. As a basis for the overview, current and potential growth of timber in the United States and the current and projected demands on the timber resource in 2000 are reviewed. Special attention is given to a plausible distribution of available wood supplies among major segments of the forest products industries, based on the anticipated needs of these industry segments by the year 2000.

ENERGY CONVERSION

MHD GENERATORS

DUCT ENGINEERING AND FLUID DYNAMICS

8438 (SAND—78-1361) **Calculation of real gas properties for MHD channel flows.** Blottner, F.G.; Larson, D.E. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 38p. Dep. NTIS, MF A01.

Portions of document are illegible.

The various subroutines used to determine the thermodynamic and transport properties of gas mixtures in chemical equilibrium are described. A simplified gas model is used for the combustion products of hydrocarbons with oxygen and a technique is developed to obtain the equilibrium composition. The required gas properties for MHD channel flow are calculated and stored in tables. The subroutines employed to interpolate within the tables to obtain the gas properties used in a channel flow code are given.

THERMOELECTRIC GENERATORS

REFER ALSO TO CITATION(S) 7535

DESIGN AND DEVELOPMENT

8439 Improvement of energy efficiency of thermoelectric heaters for direct-flow media. Tsvetkov, Yu.N. (Leningrad Tech Inst of Refrig Ind, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 12, 112-116(Dec 1977). (In Russian).

To improve energy efficiency of thermoelectric heaters under the conditions of nonmonotonous variation or increase of temperature of the nonworking medium, it is expedient to carry out partial or complete shutoff of the supply of the nonworking medium to the cold junctions of the thermopile. Formulas are derived for determining the parameters of heat carriers, thermal conductivity, and the conversion factor under the conditions of a partial or complete shutoff of the supply of the nonworking medium to the cold junctions of the thermopile.

THERMIONIC CONVERTERS

DESIGN AND DEVELOPMENT

8440 Pulsed operation of a thermionic converter. I. Plasma decay. Zherebtsov, V.A.; Talanova, V.D. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 282-288(Mar 1978).

Plasma decay is studied in the pulsed operation of a thermionic converter. The problem is solved analytically for the case in which the potential drops as the electrodes retard the electrons from the plasma. The voltage—current characteristic of the converter is found. The nonlinear equation for plasma decay is solved with nonlinear boundary conditions for an arbitrary potential distribution. This solution is used to study the current through the diode and the efficiency with which the ions are used as functions of the gas, the gap voltage, the electron current from the cathode, the pressure, the size of the gap, and the initial density. Methods for improving the pulsed output characteristics of a thermionic converter are discussed.

PERFORMANCE AND TESTING

8441 Stability of a thermionic converter. Zherebtsov, V.A.; Talanova, V.D. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 2, 207-209(Feb 1978).

An instability in an overneutralized thermionic plasma converter is studied by a simulation in which the plasma is represented by a system of charged sheets. The instability occurs in a time of the order of the electron transit time through the interelectrode gap and is excited by the electron motion. The dimensions of the growing perturbation are reduced at higher electron currents and lower values of the neutralization parameter. The instability appears above a critical value of the current. This instability is analogous to the Pierce instability.

FUEL CELLS

REFER ALSO TO CITATION(S) 8539

DESIGN AND DEVELOPMENT

8442 (CONF-771131—, pp 27-33) **Development of a regenerative solid polymer electrolyte hydrogen/halogen fuel cell for high efficiency energy storage.** McElroy, J.F. (General Electric Co., Wilmington, MA). Aug 1978.

From DOE annual chemical energy storage and hydrogen energy system contracts review; Baltimore, MD, USA (16 Nov 1977).

In Proceedings of the DOE chemical/hydrogen energy contractor review systems.

An economic and efficient means of energy storage has long been desired by electric utilities and others. Pumped hydro requires large land use whereas storage batteries can be of higher costs and lower reliability. The use of the solid polymer electrolyte with its proven long life (>45,000 demonstrated) provides the basis for a high reliability hydrogen/halogen regenerative fuel cell for energy storage. With current densities in excess of 300 ASF the system economics becomes attractive. A preliminary system description is provided for the hydrogen-chlorine cycle. The results of feasibility tests, initial cell development and preliminary cost analyses are also discussed.

ELECTROCHEMISTRY, MASS TRANSFER, AND THERMODYNAMICS

8443 (ORNL/TM—6168/V3) **Molten Carbonate Fuel Cell Program. Progress report, October 1—December 31, 1977, January 1—March 31, 1978.** Braunstein, J.; Bronstein, H.R., Padova, J.I.; Vallet, C.E. (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

During this period progress has been made in the simulation of mass transport relaxation in molten carbonate fuel cells as a guide to the design of experiments for the meaurement of needed transport and thermodynamic properties of molten carbonates. A new tile electrolysis cell was completed and experiments initiated to measure emf relaxations after electrolysis of carbonate tiles and to search for possible concentration gradients. A cell was designed and constructed, and experiments initiated, for the measurement of the emf of concentration cells with transference in Li_2CO_3-K_2CO_3 mixtures, in order to determine the relative mobilities of lithium ion and potassium ion relative to carbonate. Experiments were initiated also on determining the equilibrium lithiation of NiO in Li_2CO_3-K_2CO_3 melts under CO_2-O_2 atmospheres. A survey of literature on physical properties of stoichiometric and nonstoichiometric NiO was carried out.

8444 (ORNL/TM—6168/V4) **Molten Carbonate Fuel Cell Program. Progress report, April 1—June 30, 1978.** Braunstein, J.; Bronstein, H.R.; Cantor, S.; Padova, J.I. (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

Progress was made in the measurement and interpretation of emf relaxations following electrolysis of molten carbonate fuel cell tiles. An extensive series of measurements was carried out at 610°C at current densities from 29 to 285 mA/cm² and for electrolysis times of from five minutes to two hours. The observed decay of emf shows relaxation on three time scales: an initial rapid decay on the time scale of double layer relaxation, followed by a decay of the order of 10 minutes to an hour, characteristic of liquid state diffusion, and finally a very slow decay (hours to days) which may be related to solid state effects in the electrodes. The mass transport model provides a satisfactory representation of the intermediate relaxation. Computation of the composition dependence of the activity coefficients in Li_2CO_3-K_2CO_3 was initiated using the phase diagram, the heats of mixing and a new method for obtaining the derivative of the activity coefficients without the need for extrapolation and evaluation of unnecessary integration constants. This derivative is needed in the interpretation of both the free electrolyte transference cell measurements and the emf relaxation measurements to determine relative mobilities of lithium and potassium. Slow penetration of Li^+ into massive samples of NiO indicated the need for thinner samples in studies of lithiation of NiO under fuel cell conditions and for the preparation of lithiated NiO electrodes of known area. A series of equilibrations in Li_2CO_3-K_2CO_3 under CO_2-O_2 atmospheres is being carried out with single crystal wafers ground and polished to a thickness of 0.01 cm.

ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 8346

BUILDINGS

REFER ALSO TO CITATION(S) 8335, 8406, 8409

8445 (COO—1340-62) **Simplification of building census input for a physical model of space-heating demands.** Starr, A.M. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). 1978. Contract EY-76-S-02-1340. 4p. (CONF-7805123—1). Dep. NTIS, PC A02/MF A01.

From Conference on climate and energy; Asheville, NC, USA (8 May 1978).

There are presently in existence many computer simulation models by which one can accurately describe the energy demand of space-heating for individual structures (e.g. ASHRAE, 1971; Kusuda, 1974; Minnesota Energy Agency, 1976). These models require detailed descriptions of building structure, furnace system efficiencies, operational practices, occupancy habits, etc., in order to obtain reliable results. To use such models for an entire urban area is impractical. Two different methodologies are developed to circumvent the necessity for descriptions of all buildings. The first methodology developed for determining less detailed descriptions of buildings in an urban area uses a statistical sampling scheme wherein it is assumed that the required degree of accuracy will vary according to whether the buildings are residential, commercial, public, or industrial. The second methodology is based upon the establishment of certain economic parameters as indicators of structural building information.

8446 (LBL—6814) **Remote operation of DOE-1 on the Lawrence Berkeley Laboratory CDC 7600, 6600, and 6400 computers.** (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1978. Contract W-7405-ENG-48. 72p. Dep. NTIS, PC A04/MF A01.

How to run the DOE-1 building energy analysis program on the Lawrence Berkeley Laboratory CDC computers is described. An overview of the LBL operating system and how to run a job on the 7600 are presented. The DOE-1 program, a control card sequence for running the program, and how to store input, output, and intermediate files are discussed. A detailed description is given of the DOE-1 Weather Package.

8447 **Multi-source heat pump HVAC system.** Brody, H.M. (to International Telephone and Telegraph Corp.). US Patent 4,100,763. 18 Jul 1978. Filed date 22 Apr 1977. 14p.

The HVAC system for a building of the type that has an interior zone and a perimeter zone includes an economizer type air conditioning unit for the interior zone and a multi-source heat pump for the perimeter zone. The interior zone economizer type air-conditioning unit has a waste heat recovery coil disposed at the exhaust air dampers and connected in a closed liquid circulating loop for recovering heat from the exhausted air. The multi-source heat pump functions as an air-to-air heat pump during a cooling mode of operation during which heat is withdrawn from the air to be conditioned by standard indoor evaporator coils, said heat being rejected to the outside air by a standard outdoor condenser coil. The heat pump operates as liquid-to-air heat pump during the heating mode of operation during which heat is extracted by a chiller from the closed liquid circulating loop and is discharged to the conditioned air through the indoor coils which act as condensers during the heating mode of operation. The closed liquid circulating loop interconnects the heat pump chiller, the waste heat recovery coil and a heat storage means and may also be connected to a supplemental heat source and a solar heat collector. It is also contemplated that one or more remote water source heat pumps may be connected into the closed liquid circulating loop for heating and cooling remotely located spaces.

8448 **DIN 4701 rules for the calculation of the heat demand of buildings - general aspects of the new draft. Pt. 2.** Esdorn, H. (Technische Univ. Berlin (Germany, F.R.). Hermann-Rietschel-Institut fuer Heizungs- und Klimatechnik). *Gesund.-Ing.;* **99**: No. 7, 192-209(Jul 1978). (In German).

The main aspects of the new draft are discussed and illustrated with: Standard ventilation heat demand, heat demand of rarely heated rooms, halls, etc., greenhouses; table values for material and exchange parameters. Comparison of the results with those of the earlier version.

8449 DIN 4701 rules for the calculation of the heat requirements of buildings - basis of the new draft. Pt. 1. Esdorn, H. (Technische Univ. Berlin (Germany, F.R.). Hermann-Rietschel-Institut fuer Heizungs- und Klimatechnik). *Gesund.-Ing.;* **99**: No. 6, 149-159(Jun 1978). (In German).

In this article the changes in the 1978 draft compared with the issue of January 1959 are shown and justified. Finally, comments are made on the question of load reserves. Important changes: The most important changes, which effect the results of calculations are: a) Taking into account thermal pressures in calculating the ventilation heat requirement of tall buildings. b) Taking into account the vertical wind velocity profile in calculating the ventilation heat requirement of tall buildings. c) New determination of wind speeds at standard external temperature. d) New determination of standard external temperature. e) Omission of addition for interruption of operation. f) Raising the addition to compensate for cold external surfaces. g) Changing the internal heat transfer resistance of halls and similar rooms. Apart from these, a number of extensions are included: h) Extending the calculation process for ventilation heat requirement to rooms with room air technical plant. i) Extending the material data catalogue. j) Including calculations for some heat bridge problems. k) Including a calculation process for greenhouses. Some formal changes also took place: l) Conversion to calculations using SI units. m) Conversion to calculations with resistances instead of flow and transition coefficients. n) Development of a typewriter- and computer-calculation format sheet.

8450 Method for control of air relative humidity with reduced energy usage. Knight, J.B. (to Philip Morris Inc.). US Patent 4,089,666. 16 May 1978. Filed date 25 Jun 1976. 10p.

A method for precisely controlling air dry bulb temperature and relative humidity is described in which the dry bulb temperature is sensed so that variations therefrom produced by cooling of the air in a spray water curtain are used to control the spray water curtain heat exchange area. Additionally, the dew point temperature is sensed and used for controlling the temperature of the spray water and hence the relative humidity in the air at a desired dry bulb temperature.

8451 Heat pumps with Diesel and gas engine drive. Wermelinger, B. (Autofrigor A.G., Zurich (Switzerland)). *Oel- Gasfeuerung;* **23**: No. 4, 218-222(Apr 1978). (In German).

Two plants, an experimental one and a large-scale heat pump with Diesel engine in public salt water swimming baths, made by a Swiss firm are described. Advantages and disadvantages, operating cost and operating experience are reported on.

8452 Humidification, a profitable investment. Plume, J. (Soc Trouvay et Cauvin). *Rev. Gen. Electr.;* **87**: No. 3, 254-257(Mar 1978). (In French).

Although humidification requires power expenditure, it provides by way of compensation, heat saving. Therefore, the overall balance has to be considered. In addition, to possible power saving, humidification provides further advantages, i.e.: comfort and safety improvement for the people, maintenance of quality of some materials, environment favorable to health. It is stressed that the highest rate of mortality of microorganisms is under the conditions of the relative humidity of 50%.

8453 Experiences in the design, installation and operation of heat pumps using the atmosphere as heat source. Kirn, H. (Badenwerk A.G., Karlsruhe (Germany, F.R.)). *Elektrowaerme Int., Ed. A;* **36**: No. 2, 104-107(Mar 1978). (In German).

The design of heat pumps which use the atmosphere as heat source has been much improved during the past two years. The trend is to combine heat pump and heat exchanger to form a package which can readily be connected to the system. This eliminates the need for the services of a specialist contractor and the unit can be connected to the hot water system and the supply network like a heating boiler. The heat pump requires no fuel storage or chimney and can therefore be arranged in the building as desired or at ground level outside or immediately adjacent to the building. Noise can be kept at a reasonably low level if the unit is suitably located.

8454 Experience with dual-source electric heat pumps. Rinck, T. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen (Germany, F.R.)). *Elektrowaerme Int., Ed. A;* **36**: No. 2, 119-125(Mar 1978). (In German).

Split systems can be installed in almost all new or existing buildings. This, however, involves a great deal of work and expense so that for reasons of cost split systems can, only be used to a limited extent and this will largely remain so in the future. The outdoor installation of package-type units is particularly suitable and involves less expense while existing buildings impose restrictions on the indoor installation of such equipment. The control gear required for the heat pump should be incorporated in the latter wherever possible. This can easily be done in mass-produced units. In new buildings the heat pump can be installed at low cost for heating service water while its installation in existing buildings is attended with considerable extra expense.

8455 Electric heat pumps using the ground as source of heat. Specht, O. (Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.)). *Elektrowaerme Int., Ed. A;* **36**: No. 2, 101-104(Mar 1978). (In German).

It is already ten years ago that the first heat pumps using the ground as heat source were installed. Initially the buried heat exchanger was designed by trial and error on the basis of assumed characteristics. Research work carried out recently will, however, make it possible for such units to be dimensioned more reliably. Data on the type of ground, water content and depth of burial for the withdrawal rate and optimum supply and return temperatures have to be taken into account. For the heat exchanger a distinction is made between cooling, equilibrium, transitional and heating conditions. These four conditions indicate the individual phases in extracting heat from the ground. From the temperature gradient conclusions can be drawn as to the heat flux in the ground. If the present approach is consistently pursued it should be possible to exploit solar heat stored in the ground even more than at present.

8456 Radiation characteristics of arc tubular xenon lamps. Gavrilova, L.I.; Doinikov, A.S.; Eremin, E.A.; Pakhomov, V.K. *Svetotekhnika;* No. 1, 11-14(Jan 1978). (In Russian).

Radiation characteristics are presented relating to lamp types DKsT, DKsTV and DPKs with various ratings (luminous and erythermal efficiencies, indicatrices of radiation parameters and equivalent solid angles within various spectral intervals, spectral distribution, overall efficiency, and radiation polarization degree in various directions.

8457 Energy savings through combining of operation of heat pump and air conditioning systems. Hrycak, P. (New Jersey Inst. of Tech., Newark). pp 157-160 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Considerable savings of energy are possible through improvement of the original coefficients of performance of air conditioning and heat pump systems by storing the energy rejected during the cooling season, in order to be picked up during the heating season. The storage facility considered is foundation soil. It is shown that capacity of such heat reservoirs is very considerable, and can be made an integral part of combined air conditioning/heat pump systems for a year-around operation. Inclusion of a solar heat collector into the system will give it an additional degree of flexibility.

RESIDENTIAL BUILDINGS

REFER ALSO TO CITATION(S) 8333, 8404, 8405

8458 (COO—4058-1) **Household energy conservation system study. Final report.** (General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center). Apr 1978. Contract EY-76-C-02-4058. 30p. Dep. NTIS, PC A14/MF A01.

The areas investigated, and the procedures used to develop the preliminary design for a cost effective household energy conservation and reclamation system for waste product energies are discussed. The selected design recovers sufficient energy from household wastes to provide up to 50 percent of the heating energy for a domestic hot water system. In addition it ameliorates energy expenditures associated with trash collection and disposal, sewage collection and processing, and conserves fresh water usage and the energy associated with providing it. Secondary benefits are available from the increased potential for the use of marginal lands for residential construction. The design is shown to be compatible with existing life styles and to be cost competitive when viewed against competitive systems, and only a modest investment is required to demonstrate the system's feasibility. In accomplishing the study, household energy and water use patterns were reviewed and a baseline model established. Solid waste generation along with sewage and waste water flows were determined for the model. The areas of solid wastes and liquid wastes processing were examined for potential techniques and systems applicable to energy reclamation for a household. A number of household energy reclamation systems were then conceptualized using the most attractive elements of the individual waste processing systems. These systems were then evaluated and screened for further analysis and development. An integrated solid and liquid waste energy recovery and conservation concept was subsequently selected and a design baseline established and evaluated. An assessment of barriers to implementation has been made together with a market penetration analysis. Recommendations for phased development and dissemination are included.

8459 (DOE/CS—0040/1) **Home weaterization instructor's guide. Project RetroTech.** (Department of Energy, Washington, DC

(USA). Office of Weatherization Assistance Programs). Aug 1978. 57p. Dep. NTIS, PC A04/MF A01.

The booklet was prepared as a guide to instructors in developing lesson plans for a Home Weatherization Course that promotes the use of known retrofit technology to improve thermal characteristics and conserve energy in residential housing. Although the suggested lesson plans have been designed for a special course for supervisors of workcrews actually engaged in home weatherization, the concepts embodied in the individual lessons can also be incorporated into the curriculum of construction trades programs at vocational-technical schools at the secondary, post-secondary, or adult education levels.

8460 (DOE/CS—0040/4) **Home weatherization charts. Project Retro Tech.** (Department of Energy, Washington, DC (USA). Office of Weatherization Assistance Programs). Aug 1978. 52p. Dep. NTIS, PC A04/MF A01.

The report consists of 50 charts, tables and diagrams that depict various aspects of home weatherization. Items depicted include heat losses, thermal insulation, building materials, etc. (TFD)

8461 **Heat-conserving cooking utensil.** Noonan, J. US Patent 4,099,512. 11 Jul 1978. Filed date 27 Dec 1976. 4p.

A heat-conserving cooking utensil for use on top of an ordinary kitchen stove is described. A pot-shaped metal housing with an open bottom is placed over a stove burner. Supported inside is a cooking pan shaped generally like a frying pan, whose handle protrudes out through a vertical slot in the side of the housing. The pan can thus be inserted and removed without reaching into the housing. A cover retains the heat. The top of the cover is conically concave, so that water or grease condensing on the inside will run to the center and drip back down into the pan. The cover is provided with an adjustable vent opening to control the degree of moisture retained in the food. The cooking pans and cover may be used separately. The utensil will efficiently thaw and heat frozen snacks, and bake pastries including pies, cakes, waffles and pizza, as well as casseroles and omelets. It is suitable for roasting meat. Bacon may be fried crisp without turning it over.

8462 **How will we heat in 1988. Fuel trade does not foresee great savings.** *Oel;* **16**: No. 6, 165-167(Jun 1978). (In German).

The German fuel trade has studied the effects which the energy programme devised by the German Federal Government may be expected to have on actual energy savings of private households until 1988. The study foresees of modest success only hardly justifying the strong effort.

8463 **Heat storage and air conditioning in buildings.** Koblin, W. *Bauwelt;* **69**: No. 19, 607-614(May 1978). (In German).

The use of thermal insulation materials leads to a reduction in heating energy consumption, but at the same time buildings cool down more slowly in summer. This can mean an additional demand for air conditioning which eats away again the heating energy saved in winter. In the article, outer wall constructions are considered which also guarantee in summer good room temperatures despite better thermal insulation.

8464 **New generation of energy-saving appliances for heating and domestic hot water supply.** Hahne, J. (Bosch (R.) G.m.b.H., Wernau (Germany, F.R.). Geschaeftsbereich Junkers). *Gas Waerme Int.;* **27**: No. 5/6, 248-252(May-Jun 1978). (In German).

The Energy Conservation Act, the Clean-Air Act, and the state regulations on fuel-fired furnaces imposed new demands on the design of heating boilers. The author presents an outline of the approach used in the design of gas-fired cast-iron heating boilers.

8465 **Use of gas-fired cast-iron heating boilers with a view to the rational use of energy.** Schmitz, H. (Buderus A.G., Wetzlar (Germany, F.R.)). *Gas Waerme Int.;* **27**: No. 5/6, 268-271(May-Jun 1978). (In German).

Natural gas has gained increasing importance in recent years as a source of energy for heating purposes. In central heating there has been a distinct trend towards the use of gasfired cast iron boilers equipped with fanless burners. The author has looked into the question as to whether such heat generators can keep pace with other technologies in future in terms of economy and rational use of energy.

8466 **Rational use of energy with gas-fired equipment.** Wienkamp, H. (Gas-Geraete-Gesellschaft Dipl. Ing. Barsch und Co. K.G. Nachf., Bochum (Germany, F.R.)). *Gas Waerme Int.;* **27**: No. 5/6, 291-293(May-Jun 1978). (In German).

The demand for wall-mounted circulating-water gas heaters encouraged manufacturers to engage in further development efforts aimed at improving these appliances. The new 'boilerized' unit introduced into the market early in April this year was the outcome of these efforts and gives optimum savings in energy as its heat release is constantly adapted to the heat requirement at any given time. Its design and operation are described. The author also deals with gas water heaters featuring thermostatic control which offer maximum comfort at an average outlet temperature of 60°C and draw-off rates of 2 l/min and up.

8467 **Reducing the gas consumption to keep gas-fired fanless burner heating boilers combined with water heaters operative.** Schlee, G. (Krupp (Friedr.) G.m.b.H., Essen (Germany, F.R.)). *Gas Waerme Int.;* **27**: No. 5/6, 255-259(May-Jun 1978). (In German).

The increasing importance which must be attached to the conservation of energy has recently led to the wide-spread use of motorized waste gas valves in gas-fired heating boilers equipped with fanless burners. The author deals with the effect of such valves on the gas consumption of such heating boilers in summer. A total of six types were investigated. Considerable savings can be achieved if such motorized valves are installed upstream of the flow failure device. If installed downstream from the latter, such devices reduce the amount of gas required for keeping the boiler in operative condition only slightly or not at all. The results of measurements showed that the idle losses hitherto assumed for combination boilers with built-in or attached storage heaters were wrong.

8468 **Rating of domestic heat pumps.** Maier, R. (Kulmbacher Klimageraete-Werke, Kulmbach, Ger). *Siemens-Z.;* **52**: No. 4, 181-184(Apr 1978). (In German).

The article describes the principal features of air-to-water heat pumps for small houses and lists the requirements to be met. It is estimated and verified by readings taken that about 40% of the theoretical performance figures can be reached using pumps of the correct rating.

8469 **Heat distribution, heat insulation and water heating in conjunction with heat pumps used for residential space-heating.** Canzler, B. *Elektrowaerme Int., Ed. A;* **36**: No. 2, 113-118(Mar 1978). (In German).

The amount of heat available at different times from heat sources and the supply of peak requirements by a secondary heat generator or heat store are important criteria in the design of heat pump heating systems. An appropriate type of heat pump with manual and automatic control must be selected and proper attention given to the design and characteristics of the heat distribution system incorporating the heating surfaces and piping. Important features are heat storage capacity, adaptability to varying heat requirements, temperature level and the temperature difference. The different types of heat pumps and the thermal characteristics of the building exert an influence on the selection and design of the heating surfaces. Existing heating systems can be adapted to operate economically with heat pumps if the building is provided with suitable thermal insulation. Central water heating systems can be operated economically in conjunction with heat pump space-heating systems. The water heating system should be designed to operate largely during the off-peak periods.

OFFICE BUILDINGS

8470 **New concept for better lightning and power utilization.** Hentschel, H.J.; Pusch, R. (Siemens, Traunreut, Ger). *Siemens-Z.;* **52**: No. 4, 185-187(Apr 1978). (In German).

The high demands made on the lighting of open-plan offices are being met by a new combination of general lighting and workplace lighting. A new assessment procedure, the ESI method, utilizes the given illumination for this combined two-component lighting to optimum effect. The advantages are a reduced load rating and individual lighting for each work place.

SCHOOL, MUNICIPAL AND OTHER PUBLIC BUILDINGS

REFER ALSO TO CITATION(S) 8403

8471 **Energy-saving building technique for a sports hall.** Eser, L.; Wiemer, W. (Eser, Dittmann, Nehring und Partner, Beratende Ingenieure VDI VBI, Tamm (Germany, F.R.)). *Tech. Bau;* No. 8, 803-805(1977). (In German).

In planning the present sports hall, it was possible to clearly reduce the energy consumption with a balanced ratio of expenditure to saving. New solutions were made with a high-quality heat technical building construction, a hot water production using a heat recovery system for shower water and a ventilation system making use of the available refrigerating plant in the waste water-heat recovery system. This was connected to a smaller scale district heating pipeline and district heating conversion centre. The planning expenditure, however, is unusually high due to a great extent of special detail problems.

TRANSPORTATION

LAND AND ROADWAY

REFER ALSO TO CITATION(S) 8358, 8429, 8432

SEA AND WATER

8472 New marine medium-speed diesels of the CHRN36/40 type. Osadin, V.A.; Petrov, G.P. (Works "Dvigatel' Revolyutsii", USSR). *Energomashinostroenie;* No. 1, 3-4(1978). (In Russian).

A description is given of the new Soviet medium-speed marine diesel engines. Data on the technical performance characteristics and design features of the 6ChRN36/40 diesel engine are given and some results of tests of a single-cylinder section of the 1ChN36/40 diesel engine are presented.

8473 Analysis of load channel conductivity of marine main diesel engines by statistical dynamics methods. Levin, M.I.; Zvontsov, V.A.; Pechishchev, M.I. (State Plann Inst im. A.A. Zhdanov, USSR). *Energomashinostroenie;* No. 1, 4-6(1978). (In Russian).

A new line of investigation of the dynamic properties of diesel engines as control and regulation plants, using passive experiment and statistical dynamics methods, is considered. Some results of computation of the probabilistic characteristics of the investigated conductivity channels are presented. Expressions for transfer functions of these channels, obtained by relying on these results, are given.

8474 Effect of local volumes of a diesel engine fuel system on the velocity of propagation of flow disturbance waves along its supercharging duct. Astanskii, Yu.L. (Works"Dvigatel' Revolyutsii", USSR). *Energomashinostroenie;* No. 1, 16-18(1978). (In Russian).

Differential equations describing the axisymmetrical flow of viscous fuel in the supercharging duct of a diesel fuel feed system are presented. They take into consideration the presence of local volumes in the fuel feed system in the vicinity of high-pressure piping junctions, the place where the slot filter is situated, etc. The relationship between the velocity of propagation of the flow disturbance impulse and fuel viscosity, as well as design parameters of the system, is demonstrated.

INDUSTRY AND AGRICULTURE

REFER ALSO TO CITATION(S) 8407

8475 Protection of thermal insulation. Marks, J.B.; Holton, K.D. (Childers Prod Co, Inc, Cleveland, Ohio). *Energy Process./Can.;* **70**: No. 5, 45-46,48(May-Jun 1978).

It has been proven that it actually costs less to properly insulate process vessels, pipes, valves, and flanges, and thereby conserve energy, than not to insulate and supply sufficient additional heating or cooling capacity to cover the loss or gain of heat. Thermal insulation is, therefore, a long term investment. In any application of thermal insulation, the insulation requires protection of some type. The article outlines this type of protection and describes the currently available components, including jacketing systems, mastic systems, weather-barrier and vapor-barrier coatings, as well as logging adhesives and sealants.

ENERGY SOURCES

REFER ALSO TO CITATION(S) 7344, 7602, 7639, 7645, 8424

8476 Resource use by the petrochemical industry. Stadtherr, M.A.; Rudd, D.F. (Univ. of Illinois, Urbana). *Chem. Eng. Sci.;* **33**: No. 7, 923-933(1978).

A systems analysis of the petrochemical industry as it has developed since 1940 indicates that efficient use of natural resources has been good business practice in the manufacture of synthetics. Thus, efficient resource use is a plausible development criterion for projecting the industry's response to various economic and technological scenarios.

EQUIPMENT AND PROCESSES

REFER ALSO TO CITATION(S) 8402, 8431

8477 (ORNL/SUB—7296/1) Analysis and development of regenerated desiccant systems for industrial and agricultural drying. Final report, April—December 1977. Merrifield, D.V.; Fletcher, J.W. (Lockheed Missiles and Space Co., Inc., Huntsville, AL (USA). Research and Engineering Center). Dec 1977. Contract W-7405-ENG-26. 70p. Dep. NTIS, PC A04/MF A01.

The results are presented of a research and development effort to further develop and improve the design of a regenerated desiccant drying and dehumidification system which has more than twice the energy efficiency of conventional warm air dryers. The baseline application is for large-scale commercial grain drying, although several other applications have been identified such as space air conditioning and kiln drying of lumber. The system has excellent potential for providing a significant degree of industrial energy conservation while incurring payback periods of two to eight years to recover the added capital investment over conventional less-efficient drying methods. Although the intended energy source for the system is solar energy, the basic energy saving technique is the liquid desiccant drying process itself such that virtually any thermal energy input can be used. The use of solar energy permits further energy conservation if the additional capital investment is justified. The major goal of the present study has been to improve the cost effectiveness of the desiccant regeneration system and establish significant design improvements over the regenerated desiccant drying concept developed in previous study phases. This goal has been achieved through the use of a straightforward evaporative technique for regenerating (reconcentrating) the lithium chloride desiccant solution, in place of using the previous packed column technique, and by using a steam condenser for heat recovery. The use of this technique resulted in a system cost reduction of nearly one-third and an efficiency improvement of approximately 10%, as well as a reduction in system size and complexity.

8478 Short path freeze-dryer with integrated heat pump - concept, tests, costs. Rautenbach, R.; Hoeck, H.; Beer, W. (Technische Hochschule Aachen (Germany, F.R.). Inst. fuer Verfahrenstechnik); Eilenberg, H.J. (Suwelak G.m.b.H., Billerbeck (Germany, F.R.)). *Ger. Chem. Eng. (Engl. Transl.);* **1**: No. 2, 94-98(Jun 1978).

From Annual meeting of process engineers and 175. meeting of the European Federation of Chemical Engineering; Duesseldorf, Germany, F.R. (29 Sep - 1 Oct 1976).

The technique of 'short path freeze-drying', developed in the Institut fuer Verfahrenstechnik, in Aachen, can reduce the costs of freeze-drying if the resistance to heat transfer between the material to be dried and the heat exchanger surface is kept small and if the heat pump principle is utilised. The main elements of the short path freeze-dryer are the heat exchange surfaces for ice deposition which are installed in the immediate vicinity of the substance to be dried and from which the ice is flaked off in solid form by applying short electric impulses. The present paper describes the experiments which have been performed and discusses the costs of the process.

8479 Pipe tracing and energy conservation. Maltby, F.O. (Kilborn Ltd, Toronto, Ont). *Energy Process./Can.;* **70**: No. 5, 51-53(May-Jun 1978).

Energy consumers should not overlook the energy cost associated with line tracing. The author believes the designer of the process, equipment sizing and layout can do much more when decisions are to be made regarding the method of tracing. A review of tracing systems generally used and the associaterd capital and energy costs for a typical installation is presented. The discussion is limited to the use of tracing for freeze protection.

8480 Development of general purpose analog pneumatic device for continuous automatic measurement of efficiency of tube furnaces according to "direct heat balance". Khasmamedov, F.I. (Az SSR Inst of Pet and Chem im. M. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 1, 87-96(1978). (In Russian).

The problem of designing the analog device is solved for the first time. The furnaces concerned operate on any kind of fuel. The efficiency meter designed may be used both in the "advisory" operating mode and directly in automatic control circuits to optimize the thermal and technological operating conditions of tube furnaces.

8481 1977 TAPPI papermakers conference. Atlanta; Technical Association of the Pulp and Paper Industry (1977). 160p. (CONF-770492—). Technical Association of the Pulp and Paper Industry, $15.00.

From TAPPI papermakers conference; Chicago, IL, USA (8 Apr 1977).

A separate abstract was prepared for one paper. The remaining papers were not in scope for the data base. (RCK)

8482 Key considerations in selecting wet felts for energy savings. Waugh, R.W. (Huyck Corp., Rensselaer, NY). pp 95-101 of 1977 TAPPI papermakers conference. Atlanta; Technical Association of the Pulp and Paper Industry (1977).

From TAPPI papermakers conference; Chicago, IL, USA (8 Apr 1977).

In today's economic environment, emphasis continues to be placed on upgrading press section efficiency due to the rising costs of drying paper by evaporation in the dryer section. Wet felts can make a major contribution to reducing paper machine energy costs by increasing the dryness of the sheet into the dryer section, increas-

ing productivity by better machine efficiency, and in instances where drying is the limiting factor. Examples are given of wet felt designs as well as illustrations of the magnitude of their influence in reducing paper machine operating costs. Practical guidelines are provided in establishing a wet felt program to increase the water removal efficiency of the press section.

8483 63rd annual meeting of the Technical Section, Canadian Pulp and Paper Association. Montreal; Canadian Pulp and Paper Association (1977). 279p. (CONF-770264—P1).

From 63. meeting of the Technical Section, C.P.P.A.; Montreal, Canada (1 Feb 1977).

Thirty-nine papers were presented at the meeting. A separate abstract was prepared for each of 5 papers. The remaining 34 papers are not within the scope of the data base. (LCL)

8484 Electrical energy conservation with modern variable speed controls. Duff, D.L. (Canadrive Systems Ltd., Oakville, Ontario). pp A77-A83 of 63rd annual meeting of the Technical Section, Canadian Pulp and Papper Association. Montreal; Canadian Pulp and Paper Association (1977).

From 63. meeting of the Technical Section, C.P.P.A.; Montreal, Canada (1 Feb 1977).

Much of the energy wasted by inefficient operation of ac electric motors at either fixed or variable speed can be conserved by a motor control system which recovers this wasted energy and which provides some additional operating benefits. A quantitative comparison with other speed control systems lends insight to the savings which can be achieved.

8485 Energy losses in a dryer section and how to control them. Walker, P.J. (Midland Ross of Canada Ltd., LaSalle, Quebec). pp A119-123 of 63rd annual meeting of the Technical Section, Canadian Pulp and Paper Association. Montreal; Canadian Pulp and Paper Association (1977).

From 63. meeting of the Technical Section, C.P.P.A.; Montreal, Canada (1 Feb 1977).

The energy consumed in the dryer section of a paper machine (6.9×10^6 BTU/Ton) is analyzed. An attempt is made to break down the total energy consumption figure to determine the various energy losses. Upon establishing the energy losses steps are considered to minimize these utilizing existing technology.

WASTE HEAT RECOVERY AND UTILIZATION

REFER ALSO TO CITATION(S) 7646, 7770, 8431

8486 Energy from waste. *Betriebstechnik;* **17**: No. 7/8, 48(1976). (In German).

Rubbish combustion plants are expensive to purchase, cause high running costs and require compliance with environmental protection regulations. They are profitable if waste is present in the required quantities and is prepared suitable for combustion. Small and medium sized concerns are better served by dumping rubbish. The report gives valuable information on this.

8487 Heat extraction or reclamation apparatus for refrigerating and air conditioning systems. Jonsson, K.A. (to Sun-Econ, Inc.). US Patent 4,089,667. 16 May 1978. Filed date 27 Oct 1976. 16p.

A heat extraction or reclamation system particularly adapted to recover otherwise rejected heat from the refrigerant gas flowing through air conditioning and refrigerating systems is described. The system includes a counter-flow heat exchanger for transferring heat to a medium such as water, the heat exchanger being installed in the tubing upstream of the conventional condenser. The heat extraction system has a pump for circulating water or other medium to be heated, located on one side of the heat exchanger. Hot refrigerant gas, the so-called superheated gas flowing from the compressor of the air conditioning or refrigerating system, is circulated through the other side of the heat exchanger. The pump flow rate and the heat transfer area between the refrigerant gas and the water or other medium are chosen to ensure that the refrigerant gas outlet quality remains within limits which ensure flow continuity in operation. Refrigerant gas leaving the system will contain some liquid in the form of droplets or a small stream. The water temperature is maintained within limits by stopping the pump when the inlet water temperature reaches a predetermined maximum value. Refrigerant velocity through the heat exchanger is reduced compared to velocity at compressor discharge in some embodiments to lengthen residence time in the heat exchanger sufficiently to increase heat transfer from the refrigerant gas and yet provide an excess quantity of heat in the refrigerant gas compared to the heat removal capacity of the flowing water.

8488 Technologies for the utilization of waste energy. Kiang, Y.H. (Trane Thermal Co., Conshohocken, PA). pp 161-167 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

With decreasing fuel supplies and increasing prices for energy, technology must be utilized to provide means for the recovery of available energy from sources once considered as perishable wastes. The available and proven technologies for the utilization of waste energy are reviewed. In general, the utilization of waste energy can be classified into two categories, the use of waste energy to reduce waste disposal expense and to generate heat for process plant usage. Included in the discussion are the advantages and disadvantages of different waste heat utilization technologies and the effect of waste characteristics on the choice of recovery equipment and systems.

INDUSTRIAL WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 7225, 8375, 8380

8489 Chemical wastes: fluorocarbons and other intractable materials. Sherratt, S. (Imperial Chemical Industries Ltd., Hertfordshire, Eng.); Lawes, H.; Oldham, L.W. pp 227-241 of Incineration of municipal and industrial waste. Vol. 1. Carter, G.T. (ed.). London; Institute of Fuel (1969).

From Conference on the incineration of municipal and industrial waste; Brighton, UK (25 Nov 1969).

Problems of destroying three chemical wastes by incineration and their solution are outlined. The chemical wastes are: (a) Fluorocarbons. Residues are highly toxic, and disposal to waste dumps or to liquid effluent streams was unacceptable. Vaporization to air was practiced, but prevention was preferred to dispersion. Incineration under carefully controlled conditions was finally developed, and safety measures were incorporated. (b) Organic Tars. A toxic component is present, and special handling precautions are necessary. No satisfactory method of chemical destruction was available, and a special design of incinerator furnace was developed with safety devices incorporated. (c) Paint Residues. A complicated mixture of solid and liquid wastes was involved, and a multi-purpose incinerator was designed. After experience in operation, modifications were made to cheapen the processing costs. These are discussed.

8490 Incineration of rubber and plastics waste. Cheater, G. pp 243-258 of Incineration of municipal and industrial waste. Vol. 1. Carter, G.T. (ed.). London; Institute of Fuel (1969).

From Conference on the incineration of municipal and industrial waste; Brighton, UK (25 Nov 1969).

The incineration of commercial wastes in which tires, waste rubber, unusable off-cuts of thermoset resins or thermoplastics occur in quantity and undiluted by other materials is discussed. The problem of widely dispersed plastics occurring in domestic refuse is ignored. All rubber and plastics have a high calorific value, and therefore burn easily. There are, however, physical difficulties associated with the size of the pieces to be burned, their density, or their tendency to melt before burning. Again, incineration may be accompanied by production of corrosive materials destructive of parts of the incinerator, or of dense smoke or toxic materials constituting a health hazard. Hospital waste, which may be contaminated, presents a special problem. All these difficulties and actions to overcome them by suitable design of incinerators and by specification of the most favorable operating conditions are described.

8491 Burning low calorific value gases. Hurley, E.C. (Philblack Ltd., Avonmouth, Eng.). pp 259-275 of Incineration of municipal and industrial waste. Vol. 1. Carter, G.T. (ed.). London; Institute of Fuel (1969).

From Conference on the incineration of municipal and industrial waste; Brighton, UK (25 Nov 1969).

The weak combustible gas discharged from furnace carbon-black plants, usually called "offgas," is normally burned in boilers to generate steam. Where, as in the Avonmouth Philblack plant, the steam is used to generate electricity, and some of this is exported to the public supply system, a maximum conservation of natural resources results; the offgas replaces imported fuel, and air pollution is minimized. Because of the low calorific value of the gas, although combustion equipment is designed on orthodox lines, careful attention is required to reaction temperature, maximum recirculation, quenching, and residence time. These are discussed in detail, and successful equipment is described.

MUNICIPALITIES AND COMMUNITY SYSTEMS

REFER ALSO TO CITATION(S) 8401

8492 Use of heat-power coupling for district heating in large cities and the maneuverability requirements for power generation. Eichner, K.P.; Liebert, L.; Munser, H.; Schiering, W.; Walter, K.;

Weidlich, H.G. (Inst fuer Kraftwerke, Vetschau, E Ger). *Energietechnik;* **28**: No. 3, 108-116(Mar 1978). (In German).

Controllability of the electric power generated by means of heat-power coupling must not be given up when providing district heating for cities. Maneuverability (controllability) of power units is therefore taken as a basis for a complex evaluation when shaping the technological structure of these units. By means of a complex optimization in accordance with general economic criteria, both the economic efficiency of district heating and of the power supply are ensured. This paper was presented at the Tenth World Energy Conference in Istanbul (Sept. 1977).

CONSERVATION SERVICES

8493 Evaluating energy saving schemes. James, B. (South West Reg Health Auth, Bristol, Engl). *Chart. Mech. Eng.;* **25**: No. 6, 61-64(Jun 1978).

The engineer will often be called upon in the next decade to report on the economics of energy saving schemes and to evaluate competing schemes. Whereas decisions on expensive schemes may well be made on environmental or political grounds, and whereas the decision to insulate a roof may be made to increase resale value of a house, the engineer should be consulted to answer such questions as how does the feasibility of one scheme compare with another; what is the payback period of a scheme; at what rate would fuel prices have to rise for a scheme to become economic; what are the minimum savings that a scheme would have to make to become economic. Whereas the present test discount rate is 10%, what would be the effect of varying this value. What is the limit of capital expenditure on a scheme for it to remain economic. Procedures are developed to enable all of these questions to be answered and the technique is applied to two examples.

PUBLIC UTILITIES

REFER ALSO TO CITATION(S) 8354, 8425, 8492

8494 (ANL/ICES-TM—12) **Phase I report: solar assessment study in the support of the International Ekistics Program.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jul 1977. Contract W-31-109-ENG-38. 258p. Dep. NTIS, PC A12/MF A01.

The Community Systems Branch of ERDA is working with the Greek Government to determine how both conventional and renewable energy sources can be used to reduce the consumption of conventional fuels in a new community being planned for the coast of Crete. The general program approach is shown schematically. Available climatic, and insolation data from Crete were used to make rough estimates for the heating/cooling loads which will occur on individual buildings and for the community as a whole. These data were considered in preparing "generalized community energy system concepts" with emphasis placed on systems using renewable energy sources. The generalized energy system concepts were prepared only in sufficient detail and numbers to identify the key energy subsystem which would be used as the building blocks for most of the energy system concepts. The technical/cost performance of selected basic energy subsystem modules using renewable energy sources was estimated using both in-house analysis and outside information sources (manufacturers literature, ERDA reports, etc.). The status of the important components (collectors, engines, storage units, etc.) comprising the various key energy subsystems was then re-reviewed to provide information on component operation, physical configurations, cost, availability, manufacturers, and maintenance requirements.

8495 Investigations concerning specific requirements for the further development of district heating pipes. Pt. 1. Brachetti, H.E. *Gesund.-Ing.;* **99**: No. 5, 117-122(May 1978). (In German).

In these investigations one is concerned with part of the research programme on 'Heat Distribution' of the District Heating Study Group of the VDEW, which is supported by the (West German) Ministry of Research and Technology. The investigations are aimed at the development of test criteria for district heating pipework, by means of experiments with commercial district heating pipework systems or parts thereof. The main result should be to provide test processes, with which it is possible to examine district heating pipework systems, presupposing thoroughness and accuracy corresponding to a certain stage of development of the technology for their widespread use. The investigations are to be regarded as an expansion of the material and constructional tests in the field of 'District Heating'.

MUNICIPAL WASTE MANAGEMENT

REFER ALSO TO CITATION(S) 7647, 8458

8496 Combined dewatering and drying plants for sewage sludges. Zuerrer, H.; Oertle, J. *Escher Wyss News;* **50**: No. 2, 21-27(1977).

A new possibility is described for recycling the often problematical sewage treatment sludge. With a combined dewatering and drying plant, a dry granulate can be produced which is compatible with the environment and possesses ideal fertilizer properties. Production costs for this granulate are given also.

EDUCATION AND PUBLIC RELATIONS

REFER ALSO TO CITATION(S) 8368, 8459, 8460

ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

INTERNAL COMBUSTION ENGINES

REFER ALSO TO CITATION(S) 7860, 8556, 8557, 8559, 8561, 8562, 8563, 8564

8497 Exhaust gas purification system for an internal combustion engine. Ozaki, T.; Kohama, T.; Obayashi, H. (to Nippon Soken, Inc.). US Patent 4,100,734. 18 Jul 1978. Priority date 12 Jan 1976, Japan. 20p.

The engine exhaust gas purification system comprises an E.G.R. passage for the recirculation of engine exhaust gases from an exhaust system of an engine back into an intake system downstream of an engine throttle valve. A first E.G.R. control valve is provided in the E.G.R. passage and operatively connected to the throttle valve to control E.G.R. flow through the E.G.R. passage. A second E.G.R. control valve is provided in the E.G.R. passage upstream of the first E.G.R. control valve to control E.G.R. flow toward the first E.G.R. control valve. A valve controller is provided for the second E.G.R. control valve and operative in response to the variation in the pressure in the E.G.R. passage between the first and second E.G.R. control valves to control the second E.G.R. control valve so that the pressure is maintained substantially constant.

8498 Exhaust gas purifying system employing an exhaust gas flow controller. Sugihara, K. (to Nissan Motor Co., Ltd.). US Patent 4,100,737. 18 Jul 1978. Priority date 21 May 1975, Japan. 6p.

A damper door is swingably disposed in an exhaust system downstream of an afterburning device to open or close the exhaust tube or pipe in response to movement of a throttle valve of an air-fuel mixture supply means such as a carburetor.

8499 Apparatus for purification of waste from combustion engines. Frietzsche, G.; Krause, P.; Schulten, C. (to Paul Gillet GmbH). US Patent 4,101,280. 18 Jul 1978. Priority date 24 Dec 1975, German, Federal Republic of (F.R. Germany). 4p.

A monolith type of catalyst carrier for the exhaust system of a combustion engine is securely held in a tubular metal housing under the variations in temperature of operation by surrounding the monolith with a jacket, which extends between the monolith and the casing, and which has a thermal expansion coefficient that is equal to or greater than the difference between the thermal expansion coefficient of the monolith and that of the metal of the casing. The tubular casing also has tubular conduits on both ends with gradually decreasing diameters as the distance from the casing increases. Packing rings are provided between the peripheral edges of the monolith and the ends of the connected tubular conduits. Preferably, also, the end peripheral edges of the monolith are further protected by a flanged metal ring of which the flanged portions extend over a portion of the periphery at the ends of the monolith.

8500 Pollution reducing and fuel saving device. Fairbanks, R.D.; Fairbanks, R.D. US Patent 4,099,501. 11 Jul 1978. Filed date 10 Feb 1977. 6p.

An auxiliary fuel heating device for attachment to internal combustion engines is described for the purpose of reducing the amount of fuel consumed and reducing the objectionable polluting constituents of the exhaust gases therefrom through more efficient combustion of the fuel. The fuel is preheated for presentation to the carburetor or fuel injector in warm liquid form for admixture with air prior to introduction to the combustion chambers. The device comprises a separable housing having separate channel passages for circulation of liquid fuel and radiator liquid in heat exchanging relationship. The device is intended for use under low ambient temperature conditions such as encountered during winter months in the northern states of the United States and similar cold areas.

8501 Catalyst generator. Schena, K.R.; Selley, M. US Patent 4,090,838. 23 May 1978. Filed date 17 Mar 1976. 8p.

An apparatus and method for improving the efficiency of combustion, particularly in internal combustion engines, are described. Air is circulated at a substantially constant, controlled rate from a blower or compressor through a control valve to a plurality of release points beneath a catalyzing or catalyst-forming liquid, such as water, and is released in such a manner as to ensure the slow growth of relatively large bubbles. These bubbles break at the liquid surface, and the catalyst-laden air is then returned to the gas impelling means, e.g., blower or compressor, in which it is mixed with more air and returned to the system. A portion of the catalyst-laden air is directed to the combustion device, e.g., the carburetor or intake manifold of an internal combustion engine, the remainder being returned to contact with the catalyzing or catalyst-forming liquid.

8502 Comparison of fuel economy results from EPA tests and actual in-use experience, 1974—1977 model year cars. McNutt, B.; Pirkey, D.; Dulla, R.; Miller, C. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 44p. (CONF-780208—31).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

In reponse to growing concern over the validity of the EPA fuel economy numbers, the Department of Energy undertook a study of actual on-road fuel economy as it compares to the EPA numbers. The development of the data base for that study, the analysis techniques used for the initial phases of the work, and the preliminary results of that analysis are presented. Data on over 5000 in-use vehicles were collected for model years 1974 to 1977. Data were obtained from a number of private and government groups for vehicles in fleet and typical consumer use, from on-road tests, and from in-use dynamometer tests. Comparisons using linear regressions were made between these mpg values and the EPA certification results for the same models. The results describe these differences as a function of vehicle mpg and model year. Other more specific comparisons are also made. An analysis of in-use fuel economy ranking, compared to the ranking by the EPA mpg numbers, is presented.

8503 Closed loop control for adaptive lean limit operation. Leshner, M.D.; Stuart, J.W. Jr.; Leshner, E. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—32).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Although an engine's lean limit fuel-air ratio may be easily found experimentally, it is difficult to predict accurately due to the influence of speed, load, ambient conditions, ignition characteristics, fuel chemistry, engine wear, etc. A new closed loop feedback control which adaptively tracks the engine's instantaneous lean limit using only one engine sensor is described. Test data are presented which indicate the control system response to changes in ignition timing, fuel chemistry, speed, and load. Results from laboratory and field tests indicate a significant improvement over programmed fuel-air scheduling systems, both in fuel economy and exhaust emissions.

8504 Experimental approach to reduction technique for engine noise in passenger compartment. Uchiyamada, T.; Kunieda, T. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 11p. (CONF-780208—103).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

High frequency noise in the passenger compartment which is caused by transmitted engine noise is disucssed. For the purpose of noise reduction, several evaluation methods were developed. For the evaluation of a body transmission loss, a combination of a reverberant room and an anechoic room was used. The noise absorption of the compartment was evaluated under the concept of the saturated sound pressure level. Sufficient standard samples were measured to support the noise reduction development.

8505 Transient system optimization of an experimental engine control system over the federal emissions driving schedule. Dohner, A.R. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 18p. (CONF-780208—83).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

With the fuel economy and emission requirements more demanding than ever and passenger-car engine control systems more sophisticated than ever, there exists a need for a methodical procedure to optimize the fuel economy subject to emission limits of the entire engine-vehicle-aftertreatment system over the federal fuel economy and emission tests. The optimal feedback control functions should account for: (1) transient system interactions; (2) cold start engine-catalytic converter warm-up dynamics (3) exhaust aftertreatment; (4) driveability; and (5) any repeatable unknown phenomena which affect end-of-test fuel consumption or emissions. An experimental Transient System Optimization (TSO) procedure which meets these requirements is discussed.

8506 Engines with stratified charge. Kerimov, N.A.; Mektiev, R.I. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 15p. (CONF-780208—54).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A method of operating fuel injection engines with stratified charge and prechamber-torch ignition is presented. The ejection effect has been employed for cleaning the prechamber of burned gases and filling it with an air-fuel mixture of the necessary composition. The ejection effect is produced by the fuel jet injected through the prechamber which makes it possible to scavenge the prechamber without the use of third valve. In addition, this method provides the necessary stratification of charge along the direction of flow of burned gases out of the prechamber. Investigations carried out on single cylinder research test bench and on an experimental multicylinder engine created by modifying the serially produced automotive engine show that the proposed method of operation makes it possible to improve the power and economy parameters of the engine with a sharp reduction of toxic components in the exhaust gases at the same time.

8507 Thermodynamic mode of operation for a compound internal combustion engine. Ingeln, T.K. German(FRG) Patent 2,624,318/A/. 15 Dec 1977. 15p. (In German).

A compound internal combustion engine with the following advantages is described: Higher efficiency and lower emission of hydrocarbons and carbon monoxide. In this engine, two internal combustion engines are connected in series; the fuels (carbon monoxyde and hydrocarbons) still present in the exhaust gases of the first engine are combusted with additional fresh air in the second engine, and the energy released is used to drive the vehicle. The method may be applied in Otto engines as well as in Stirling motors; its one disadvantage is the higher weight of the compound engine.

SPARK-IGNITION

REFER ALSO TO CITATION(S) 8567, 8568, 8569

8508 Spark-ignition internal combustion engine equipped with exhaust gas recirculation system. Nakajima, Y.; Hayashi, Y.; Takagi, Y. (to Nissan Motor Co., Ltd.). US Patent 4,100,736. 18 Jul 1978. Priority date 22 May 1975, Japan. 6p.

An air-fuel mixture containing a relatively large amount of recirculated exhaust gases is smoothly and rapidly burned by producing squish turbulence and igniting the mixture with a plurality of spark plugs.

8509 Some lines of development of electric systems for gas/air mixture ignition in reciprocating gas engines. Kollerov, L.K. (Cent Sci Res Diesel Inst, USSR). *Energomashinostroenie;* No. 1, 41-43(1978). (In Russian).

A brief survey of the current trends in fuel ignition systems in use and under development in the United States, West Germany and Canada is presented.

8510 Reduction of octane requirement by knock sensor spark retard system. Kraus, B.J.; Godici, P.E.; King, W.H. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 18p. (CONF-780208—25).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A 1975 California model automobile with an 8 : 1 C.R. 350 CID engine was modified by increasing the compression ratio to 9 : 1 which resulted in improved fuel economy. The higher NO/sub x/ emissions were reduced to the base level by substituting a back pressure-controlled EGR unit for the original valve and increasing the EGR flow. Octane requirement was controlled by a knock sensor-actuated spark timing retard system. The knock sensor (accelerometer) was attached to one of the cylinder heads of the engine. When knock occurred, the vibration was picked up by the sensor, the signal was filtered to remove some of the engine background noise, and the knock pulse was detected. When the amplitude of the detected knock signal exceeded a threshold, the spark timing was retarded. When no knocking was detected over a waiting period, the timing was advanced back to its normal schedule. Using this system, the vehicle's octane requirement can be lowered several numbers with some performance debit, i.e., slower acceleration times.

8511 Laser ignited internal combustion engine: an experimental study. Dale, J.D.; Smy, P.R.; Clements, R.M. Warrendale, PA;

Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—71).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Preliminary test results are presented for a spark ignition engine which used a focus laser beam and conventional spark ignition as ignition sources. The results show that for a steady running single-cylinder engine with MBT spark timing and fixed throttle position, engine performance and efficiency are improved, extension of the lean limit of operation by 5 air-fuel ratios is possible, and more NO is produced with laser ignition. The effects of EGR are also examined. The CO and HC emissions are essentially the same. With the laser, the spark location was found to have little effect on performance except when it was moved near the combustion chamber wall. The minimum laser pulse energy required for steady engine operation seems to be dictated by the minimum energy required to achieve breakdown of the laser pulse in air at the same pressure.

8512 Distributorless ignition system: solid state high voltage distribution with low RFI emissions. Asik, J.R.; Moyer, D.F.; Rado, W.G. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 13p. (CONF-780208—72).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

By utilizing high voltage diodes, a special ignition coil, and a special electronic module, a distributorless ignition system (DIS) having solid state high voltage distribution has been designed and constructed. The ignition coil has two opposite polarity high voltage outputs that alternate in phase upon each firing. Each high voltage terminal is connected to two spark plugs through a pair of high voltage diodes that are arranged in back-to-back polarity. The basic DIS package is suitable for igniting a four cylinder engine. DIS has significant advantages in the areas of RFI emissions, packaging, and "rotor registration".

8513 Correlations of combustion data for S. I. engine calculations: laminar flame speed, quench distance and global reaction rates. Lavoie, G.A. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 19p. (CONF-780208—88).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A survey was made of existing data on laminar flame speed and two-plate quenching distance for the propane -O_2-N_2 system. Semi-empirical correlations were derived to express these quantities as functions of equivalence ratio, pressure, flame temperature and residual gas fraction, over the range of parameters appropriate to engine operation. Application of the quench-distance correlation to calculations of engine hydrocarbon-emissions is discussed in the light of available experimental data on the one-wall quenching process. Also for use in hydrocarbon-emission calculations, a global reaction rate expression for engine hydrocarbon-oxidation has been obtained by fitting an Arrhenius expression to the available rate data in the temperature range $850°K < T < 1250°K$.

8514 Performance advantages of synthesized commercial engine oils. Hetrick, S.S.; Keller, J.A.; Lowther, H.V. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 14p. (CONF-780208—108).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Two synthesized commercial engine oils were developed and extensively evaluated to document a number of unique performance benefits. The benefits include significant fuel savings in heavy-duty diesel truck engines, excellent low temperature fluidity, engine cleanliness and antiwear protection, extended drain capability, and good oil economy. The results of standard and double-length laboratory engine tests, chassis rolls tests and confirming field tests are discussed.

8515 Effects of ignition on the engine and emissions. Schwarz, H.; Bertling, H. (Bosch (R.) G.m.b.H., Stuttgart (Germany, F.R.). Geschaeftsbereich Kraftfahrzeugausruestung 1). *Bosch Tech. Ber.;* **5**: No. 5/6, 220-225(1977). (In German).

The combustion of the fuel-air mixture, and hence the performance of a spark ignition engine, can be influenced by the type of spark plug, the timing and the spark energy. The influences on exhaust gas composition, fuel consumption, drivability and maximum engine power are dependent on the mixture composition in a characteristic manner. From these relationships, indications for the application of new ignition processes and ignition system design can be derived.

DIESEL

REFER ALSO TO CITATION(S) 8514

8516 Investigation of the operation of the 6CHN21/21 diesel engine with reduced compression ratio. Kosyak, A.F.; Kuz'min, G.S. (Cent Sci Res Diesel Inst, USSR). *Energomashinostroenie;* No. 1, 6-7(1978). (In Russian).

Results of investigations of starting properties of the 6ChN21/21 diesel engine with a reduced compression ratio are presented. Principal parameters of the working process with two-stage supercharging up to the average effective pressure of 20 kgf/cm$sup 2$ with regular adjustments of the fuel apparatus and gas distribution mechanism are presented.

8517 Turbocompressor turbine blade vibrations. Budchenko, A.I. (Cent Sci Res Diesel Inst, USSR). *Energomashinostroenie;* No. 1, 14-16(1978). (In Russian).

Specific features of forced vibrations of turbine blades of turbocompressors in a diesel engine pulse supercharging system are considered. A method of evaluation of the level of maximum amplitudes of turbine blade vibrations is presented. In particular, the effect of the periodic character of the disturbing forces on the character and amplitude level of vibration of turbine blades of turbocompressors with two and four inlets is investigated. It is found that in turbines with 4 inlets maximum amplitudes of vibrations are 30-40% higher than in those with 2 inlets.

8518 Standardization of technical requirements regarding lubricating oils for marine, locomotive, and stationary diesel engines. Davydov, P.I.; Mikutenok, Yu.A.; Sibarova, I.I. (Cent Sci Res Diesel Inst, USSR). *Energomashinostroenie;* No. 1, 23-24(1978). (In Russian).

Out of 10 most widely used in the USSR lubricating oils for diesel engines, nine are made by enterprises of the Ministry of Petrochemical Industry according to the ministry's specifications and not according to State standards. These specifications do not indicate the principal engine properties of the oils on the basis of tests. It is urged that State standards be worked out for these lubricating oils.

8519 Integrated improvement of performance indices of CH12/14 series-produced diesel engines. Bogdanov, G.B. (Tokmak Works im. S.M. Kirov, Kirg SSR). *Energomashinostroenie;* No. 1, 33-35(1978). (In Russian).

Investigations made by the S.M. Kirov Diesel Engineering Works in Tokmak, Ukraine, to improve and unitize 6Ch and 6ChN12/14 diesel engines of the entire range, from 80 to 180 HP, are described. As a result, 350 items of assemblies and parts (without fasteners) have been eliminated from manufacture. Standardization is based on the most supercharged modification of the 6ChN12/14 diesel engine with the capacity of 180 HP and the use of some improved designs of assemblies and parts.

8520 Improvement of air purification systems for diesel engines. D'yakov, R.A.; Presnyakov, V.N. (Cent Sci Res Diesel Inst, USSR). *Energomashinostroenie;* No. 1, 35-37(1978). (In Russian).

The present trends in the development of air purification systems are considered. In particular, improvement of air purifiers with a cardboard filtering element is described.

8521 External surface noise radiation characteristics of truck diesel engines: their far-field signatures and factors controlling abatement. Trella, T.; Mason, R.; Karsick, R. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 31p. (CONF-780208—17).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The results of a comprehensive study dealing with surface noise radiation characteristics and the ranking of sources on three truck diesel engines are presented. A special acoustic facility constructed to emphasize the acquisition of diesel engine noise data is described. Information is presented on measurement methodology and its viability for quantification of engine noise, directivity, and radiation patterns from engine surfaces. Acoustic measurements, conducted over a range of engine loads and speeds, include spectral analysis of the sound pressure field derived from a thirty-two microphone spherical array. Various noise identification techniques are explored under comparative testing to ascertain potential candidates for quantification and ranking of engine external surface radiation. For the engines studied, the sound power output varies, depending on design; the loudest being the naturally aspirated; and the quietest being of prechamber design. This range varies between 8 and 10 dB(A) at maximum throttle and is speed dependent. Turbocharged engines exhibit a market change in sound power output under increased load conditions. The sound pressure field of two in-line turbocharged four-stroke diesel engines contained a high degree of asymmetry whereas the sound pressure field of a two stroke vee

configuration engine appeared representative of a finite monopole acoustic radiating source. Major external engine surface acoustic radiators, common to all engines tested, included engine front, block sides, and valve covers. Other major external sources were aftercoolers and exhaust manifolds for specific engine designs. Oil pan noise, although a lesser contributor to overall engine noise, depends on factors which include the design, material and construction. Finally, comparisons are made of noise data acquired for the acoustic facility and data acquired for the same engine installed in a typical highway truck chassis located out of doors.

8522 Characteristics of the Perkins 'squish lip' direct injection combustion system. Middlemiss, I.D. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 13p. (CONF-780208—30).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The application of a novel combustion chamber of re-entrant form to a high speed direct injection diesel engine is described. A parametric study with the major dimensions of the chamber as variables shows the relationship between oxides of nitrogen, specific fuel consumption and smoke emission. Control of pollutants is demonstrated at retarded injection timings without significant deterioration in performance. The major factors affecting hydrocarbon emission are presented and the combustion system is shown to comply with the most stringent exhaust emission legislation yet proposed.

8523 Designing adiabatic engine components. Stang, J.H. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—39).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A procedure to analyze and design adiabatic diesel engine components was developed. The analytical basis for the procedure is presented. An experimental study of related thermal boundary conditions in the combustion chamber was conducted. Mean effective gas temperatures as high as 2200°F were measured. A new adiabatic diesel piston, using a ceramic top, was designed and demonstrated using the procedure. Initial engine testing of the piston is encouraging, with full design power being achieved. The piston is considered the critical component in the overall development of an adiabatic diesel engine.

8524 Investigation of a diesel exhaust aerosol. Kittelson, D.B.; Dolan, D.F.; Verrant, J.A. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 10p. (CONF-780208—22).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A study of the exhaust aerosols produced by a single cylinder Onan diesel engine using a rapid dilution sampling system is described. Diluted exhaust aerosols were analyzed with an electrical aerosol analyzer (EAA) and a transmission electron microscope. Mass concentrations of particulate matter were determined by gravimetric filter analysis. Volume mean diameters observed with the EAA were about 0.1 μm. Mass concentration measurements made with filters were in qualitative agreement with those calculated from the aerosol volume concentrations measured with the EAA.

8525 Three-dimensional velocity measurements by laser anemometry in a diesel engine cylinder under steady state inlet flow conditions. Wigley, G.; Hawkins, M.G. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 11p. (CONF-780208—34).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Three dimensional velocity measurements of the in-cylinder aerodynamics in the steady air-flow rig for two different Diesel cylinder heads were obtained by laser anemometry. Complex recirculating flows with high mean velocity gradients were found while the fluctuating component of velocity was relatively constant. Vector addition of two components in turn allowed rapid comparison to be made of the air-flow characteristics between cylinder heads and comparison with earlier hot wire and vane anemometer measurements. The directed port cylinder head was found to produce two main vortices whereas a cast helical port produced a flow which approached simple solid body rotation.

8526 Velocity measurements in motored engines: experience and prognosis. Hutchinson, P.; Morse, A.; Whitelaw, J.H. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 9p. (CONF-780208—35).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Measured values of velocity and associated turbulence properties have been obtained in a motored single-cylinder Diesel engine and in a plexiglass simulation engine. The quality of the signals obtained from the real engine and the corresponding useful data rate are quantified and discussed. As a consequence, it is shown that measurements in real engines are likely to relate to crank-angle intervals of the order of 10 degrees. The implications of this conclusion are quantified by analysis and by measurements in the plexiglass engine. The results, from the motored Diesel engine, also show that values of velocity cannot be measured throughout the cylinder cavity. It is argued that best advantage can be obtained from laser-Doppler anemometry by conducting a small number of measurements in a real engine; demonstrating that these correspond closely to corresponding measurements in a plexiglass engine with the same geometrical arrangement; and using the plexiglass engine to determine the influence of important parameters such as piston-crown shape, head shape, valve arrangements, etc.

8527 Densified silicon carbide: an interesting material for diesel applications. Torti, M.L.; Lucek, J.W.; Weaver, G.Q. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 13p. (CONF-780208—36).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

One class of ceramic materials that is being considered for application in diesel environment is the densified silicon carbide. The composition, microstructure, physical and mechanical properties of several members of this family of materials are discussed along with illustrations of the current state of the art of component complexity.

8528 Current developments in diesel engine oil technology. Zalar, F.V.; Nisbett, D.E. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 13p. (CONF-780208—109).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Multifunctional or universal lubricating oils which service both gasoline and diesel engines have gained widespread commercial acceptance. Since 1970, numerous changes and additions have altered the performance tests and specifications which define the quality of these lubricants. New parameters include single cylinder and multicylinder diesel engine testing, valve train wear protection, clutch plate friction retention, extended drain interval and lubricant related fuel economy. In response to these requirements, new additive systems were developed. The observed base oil-additive-engine test interactions are discussed and the performance of one of these additive systems to that of the old is compared.

8529 Exhaust gas recirculation system for diesel engines. Stumpp, G.; Banzhaf, W. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—111).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Exhaust gas recirculation is an effective means to reduce NO/sub x/-emissions of diesel engines. Unfortunately too high EGR rates increase the emissions of hydrocarbons, carbon monoxide and soot. So EGR has to be controlled precisely. An EGR-system for diesel engines is described that senses the air-flow and the fuel-flow of the engine and limits the EGR-rate so, that the air-fuel-ratio is lean enough for a clean combustion. Furthermore, the emission results which were obtained with the described EGR-system on different diesel passenger cars are shown.

8530 Diesel order sampling and analysis using the Diesel Odor Analysis System (DOAS). Cernansky, N.P.; Savery, C.W.; Suffet, I.H.; Cohen, R.S. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—110).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Diesel odor sampling and analysis techniques and procedures using the Arthur D. Little, Inc. Diesel Odor Analysis System (DOAS) were evaluated. Reproducibility of +- 0.1 TIA unit at the 2.0 TIA level and +- 0.2 TIA unit at the 1.5 TIA level are achievable if a consistent, well defined sampling procedure is used. Significant odor sample trap breakthrough and sample volume effects were isolated. The study indicates that care must be given to defining a standard odor sampling configuration and procedure.

8531 Cooperative study of heavy duty diesel emission measurement methods. Perez, J.M.; Clemmens, W.C.; Broering, L.C.; Johnson, J.H. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 21p. (CONF-780208—19).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A cooperative test program was conducted by the CRC-APRAC CAPI-1-64 Composition of Diesel Exhaust Program Group

to evaluate the technical aspects of a proposed EPA recommended Heavy Duty Diesel Emission Measurement and Test procedure. The proposed changes affected the sampling configurations and the types of instruments used. Six participants studied the effects of a number of variables on the proposed changes and evaluated some alternative systems that included both CHEMI and NDIR instruments. The tests were conducted at one site using a multi-cylinder engine operating on the 13-Mode Cycle. Equivalency of systems was demonstrated and the best performance was obtained with a special NDIR system.

8532 Characterization of the hydrocarbon and sulfate fractions of diesel particulate matter. Khatri, N.J.; Johnson, J.H.; Leddy, D.G. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 24p. (CONF-780208—20).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

One of the more objectionable aspects of the use of diesel engines has been the emission of particulate matter. A literature review of combustion flames, theoretical calculations and dilution tunnel experiments have been performed to elucidate the chemical and physical processes involved in the formation of diesel particulate matter. A comparative dilution tunnel study of diluted and undiluted total particulate data provided evidence supporting calculations that indicate hydrocarbon condensation should occur in the tunnel at low exhaust temperatures. The sample collection system for the measurement of total particulate matter and soluble sulfate in particulate matter on the EPA 13 mode cycle is presented. A method to correct for hydrocarbon interferences in the EPA barium chloranilate method for the determination of sulfate in particulate matter is discussed.

TURBINE

8533 (DOE/NASA/1040—78/4) **Correlations of catalytic combustor performance parameters.** Bulzan, D.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1978. Contract EC-77-A-31-1040. 16p. (NASA-TM—79014; CONF-781044—1). Dep. NTIS, PC A02/MF A01.

From 3. workshop on catalytic combustion; Asheville, NC, USA (3 Oct 1978).

Performance parameters were correlated for a catalytic combustor. Correlations for combustion efficiency, percentage pressure drop and the minimum required adiabatic reaction temperature necessary to meet emissions goals of 13.6 g CO/kg fuel and 1.64 g HC/kg fuel are presented. Combustion efficiency was found to be a function of the cell density, cell circumference, reactor length, reference velocity, and adiabatic reaction temperature. The percentage pressure drop at an adiabatic reaction temperature of 1450°K was found to be proportional to the reference velocity to the 1.5 power. The percentage pressure drop was also found to be proportional to the reactor length and inversely proportional to the pressure, cell hydraulic diameter, and fractional open area. The minimum required adiabatic reaction temperature needed to meet the emissions goals was found to increase with reference velocity and decrease with cell circumference, cell density, and reactor length. A catalyst factor was introduced into the correlations to account for differences between catalysts. Combustion efficiency, the percentage pressure drop, and the minimum required adiabatic reaction temperature were found to be a function of the catalyst factor. The catalyst factor ranged from 0.12 to 1.52. The data was from a 12-cm-dia test rig with noble metal reactors using propane fuel at an inlet temperature of 800°K, a pressure of 3 x 10^5 Pa, and reference velocities from 10 to 20 m/s.

8534 (UCID—17804-77, pp 47-58) **Preliminary design of a ceramic helical-rotor expander.** Myers, B.; Mohr, P.B.; Deis, G. 18 May 1978.

In Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.

A class of ceramic expansion engines believed to have the potential for operating reliably and efficiently on a variety of fuels is being developed. Such engines, operating essentially uncooled at temperatures in excess of 1350°C, appear attractive for applications in automotive, propulsion, industrial, and topping-cycle service. The primary objective of the present program is to extend the concept of the previous work to the development of fuel-tolerant ceramic engines for Brayton-cycle service at temperatures above 1300°C with a minimum of cooling. The first part of the program, now underway, involves preliminary design and applications. In the second program phase, a small 125-mm ceramic expander with nominal power of about 100 hp will be constructed to demonstrate the essential validity of the concept. Expanders of such scale would be applicable to the propulsion of automobiles or other small vehicles and to auxiliary power service. In later program phases, the development of such engines and also engines to intermediate sizes of 500-to-600 mm rotor dia and from 1000-to-3000 hp for industrial cogeneration systems or large vehicle propulsion is planned. Information is presented on design concepts for ceramic expanders; rotor and bearing design; materials considerations; performance characteristics and testing; and stress analysis. (LCL)

8535 Gas turbine application in transit vehicles. Tarkir, R.A.; Buckel, H.H. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 14p. (CONF-780208—33).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

During the engineering and public demonstration testing phases of the Transbus Program, the three prototype coaches equipped with gas turbine powerplants exhibited some advantageous operational characteristics that warranted further investigation. Consequently, the gas turbine engine was investigated as a potential power source for transit coaches. An in-depth survey was conducted of gas turbine engine manufacturers, whose products may be suitable for transit coaches, to determine their merits as compared to those of the diesel engine. Only Detroit Diesel Allison Division (DDAD) has a product sufficiently developed to warrant serious consideration of volume production. The investigation indicates that while current engines are not economically justifiable, the gas turbine engine may be potentially superior to the diesel.

ROTARY

REFER ALSO TO CITATION(S) 8573

EXTERNAL COMBUSTION ENGINES

STIRLING CYCLE

8536 (COO—4396-2) **Automotive Stirling Engine Development Program. Quarterly technical progress report, January 1978—March 1978.** (Ford Motor Co., Dearborn, MI (USA)). 1978. Contract EC-77-C-02-4396. 97p. (NASA-CR—159435). Dep. NTIS, PC A05/MF A01.

This report covers the second quarter (January to March, 1978) effort of the Ford/DOE Automotive Stirling Engine Development Program, specifically Task I of that effort which is Fuel Economy Assessment. At the end of the previous quarter the total fourth generation fuel economy projection was 22.1 MPG (gasoline) with a confidence level of 29%. At the end of this quarter the total fourth generation fuel economy projection was 23.7 MPG (gasoline) with a confidence level of 40%. The confidence level for the original 20.6 MPG goal has been increased from 32% to 53%. Engine 3X16 was removed from the dynamometer test cell because of a leak in the heater head. Engine 3X17 was then installed into the test cell and has accumulated a total of 120 hours of variable speed running time. Progress in those sub-tasks which are directly related to fuel economy and those sub-tasks which are not directly related to fuel economy but are an integral part of the Task I effort is reported.

ELECTRIC-POWERED SYSTEMS

REFER ALSO TO CITATION(S) 8546, 8547, 8556

8537 (DOE/CS—0026/3) **Electric and hybrid vehicle program. Quarterly report, April—June 1978.** (Department of Energy, Washington, DC (USA). Div. of Transportation Energy Conservation). Aug 1978. 20p. Dep. NTIS, PC A02/MF A01.

Highlights of the electric and hybrid vehicle program are presented. (TFD)

8538 dc electric car with auxiliary power and ac drive motor. Williams, J.R. (to Trans Research Development Corp.). US Patent 4,099,589. 11 Jul 1978. Filed date 20 Dec 1976. 4p.

An electric car is provided with a dc drive motor powered by a conventional storage battery and an ac drive motor powered by the combination of an ac generator driven by an auxiliary internal combustion engine. The car may be driven by the dc motor alone, for example during short range stop and go driving, or it may be driven by the ac motor alone, for example during relatively constant speed long range driving, or it may be driven by both motors in combination when increased power is required.

8539 Soviet pushing electrochemical power for vehicles. Busi, J.D. (Army Foreign Science and Tech. Center, Charlottesville, VA). *Army RD and A;* **19**: No. 2, 12-13(1978).

The basic need in developing practical all-electric vehicles for urban transit within the USSR is the development of adequate electrochemical power sources. These sources must be reliable,

correspond to established Soviet industrial and automotive standards, and satisfy predetermined driving and climatic specifications. Three types of electrochemical power sources being considered in the USSR are discussed. Conventional lead-acid and alkaline-type storage batteries; electrochemical fuel cells; and advanced, unconventional, high- energy-type traction batteries are discussed. The Soviets initially stressed the development of lead-acid traction batteries for all-electric vehicles, but after finding their drawbacks to be low-energy density and poor low-temperature charge/discharge characteristics, they shifted their traction battery research effort to alkaline systems. The development of alkaline traction batteries satisfies both driving range and low-temperature requirements. The Soviets have investigated and demonstrated fuel cells for electric ground-propulsion applications, established an extensive theoretical and fundamental data base, but have not progressed beyond the advanced development stage. They have conducted basic research and limited exploratory development of unconventional high energy battery systems. These batteries couple strong alkaline earth metals as anodes and strong oxidants such as halogens or chalcogens as cathodes. An analysis of all these potential electrochemical couples has resulted in the sodium-sulfur, and lithium-sulfur battery systems as the most promising unconventional, high-energy battery types for future (beyond 1985) electric vehicle applications.

8540 Crashworthiness tests on two electric vehicles. Enserink, B.; Hackney, J.R.; MacLaughlin, T.F. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 14p. (CONF-780208—23).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Crashworthiness aspects of two electric vehicles were evaluated in a modest test program. One vehicle was subjected to low-speed pendulum and barrier tests and static rollover. A second vehicle was subjected to a dynamic rollover using the procedure specified in FMVSS 208. Potential safety problems were exposed, and are addressed.

8541 Applicability of safety standards to electric and hybrid-vehicles. MacLaughlin, T.F. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 13p. (CONF-780208—24).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A study was conducted by the National Highway Traffic Safety Administration to determine the applicability of Federal motor vehicle safety standards to electric and hybrid vehicles. Addressed in the study were vehicles to be included in the demonstration fleets called for in Public Law 94-413 and vehicles anticipated for future consumer use. Descriptions are given of existing and future electric and hybrid vehicles, and results of safety tests are reported. It was concluded that Federal safety standards, with few exceptions, should be applicable to electric and hybrid vehicles, with the possible exception of special purpose, limited performance and use vehicles.

8542 Test and evaluation of 23 electric vehicles for state-of-the-art assessment. Dustin, M.O.; Denington, R.J. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 10p. (CONF-780208—81).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The Electric and Hybrid Research, Development and Demonstration Act of 1976 required ERDA to develop data to determine the state-of-the art of electric and hybrid vehicles. NASA, in response to ERDA's request, tested 18 electric vehicles. The U.S. Army's MERADCOM tested four electric vehicles and the Canadian Government tested one. Eleven of the electric vehicles were passenger cars and 12 were commercial vans. Tests were conducted in accordance with an ERDA test procedure which is based on the SAE J227a Test Procedure. Tests included range, acceleration, coast-down, and braking. The paper presents the results of the tests and comments on reliability.

8543 Electric vehicles in Germany: present and future. Bader, C.; Stephan, W. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—12).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

As long as economic considerations keep electric transport vehicles in the limelight of interest, the arguments raised in favor of the electric vehicle in general will prove unconvincing. In the drive system, the separately excited shunt-wound dc motor is becoming widely acknowledged as traction motor; current developments deal with the replacement of electric power control units by mechanical components. Hybrid drive units are mainly employed in buses; so far no uniform solution has evolved. List prices of electric transport vehicles reveal the financial burden caused by energy storage units and their maintenance.

8544 Overview of electric vehicles in the United States. Esposito, V.J. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 4p. (CONF-780208—13).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A review of the scope and objectives of the Department of Energy's Electric and Hybrid Vehicle Program is presented. Current status is outlined as of February 1978 for the demonstration and technology development efforts, including both vehicle and battery developments. Performance specifications are noted for the first 200 to 400 vehicle demonstration in 1978 and for the near-term Department of Energy integrated electric vehicle development. Although competitive success of electric and hybrid vehicles is questionable for the next decade, eventual commercial acceptance of such vehicles as a major petroleum conservation tool is predicted.

8545 U.K. electric vehicle development programmes. Samuel, J.M.G. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 7p. (CONF-780208—11).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Two aspects of electric vehicle development in the UK are discussed; vehicle chassis, hardware and battery development and operational experience. Electric delivery vans of the one to two ton payload range in the Lucas and Chloride programs are discussed. The improving prospect for molten sodium sulfur battery in large vans and buses is examined. The GLC "London Goes Electric" scheme for placing up to 62 vehicles in service in Central London is covered in addition to the Electricity Council trial of 60 Enfield city cars.

HYBRID SYSTEMS

REFER ALSO TO CITATION(S) 7860, 8537, 8556

8546 (SAN—1213-02) **Near-term electric vehicle program. Phase II: mid-term summary report.** (General Electric Co., Schenectady, NY (USA); AiResearch Mfg. Co., Torrance, CA (USA)). Aug 1978. Contract EY-76-C-03-1213;EY-76-C-03-1294. 427p. (SAN—1294-02). Dep. NTIS, PC A19/MF A01.

The Near Term Electric Vehicle (NTEV) Program is a constituent element of the overall national Electric and Hybrid Vehicle Program that is being implemented by the Department of Energy in accordance with the requirements of the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976. Phase II of the NTEV Program is focused on the detailed design and development, of complete electric integrated test vehicles that incorporate current and near-term technology, and meet specified DOE objectives. The activities described are being carried out by two contractor teams. The prime contractors for these contractor teams are the General Electric Company and the Garrett Corporation.

8547 (UCID—17804-77, pp 59-68) **Analysis of alternative transportation systems.** Bonicelli, M. 18 May 1978.

In Mechanical Engineering Department, Research Engineering Division 1977 activities highlights report.

A research program for developing alternatives to the internal combustion engine (ICE) in order to reduce petroleum consumption by automobiles is described . Technical analyses have been performed on energy storage devices and energy storage propulsion systems for automobiles. These studies concluded that a number of energy storage power systems are technically capable of providing future ICE-equivalent vehicles, but many technical and economic problems must be overcome for them to be feasible for large scale commercial applications. Regenerative braking systems were investigated with the conclusion that these can be cost-effective for heat-engine-powered commercial vehicles. Finally, a flywheel-battery power system with a small internal combustion engine is described. This system extends the mileage range of the automobile and prolongs battery life by making it possible to limit battery depth of discharge. This so-called transition vehicle can compete with today's ICE vehicles in terms of fuel cost, performance and range and is recommended for use until improved batteries can be developed for the all-electric vehicles foreseen for the 1990's. (LCL)

8548 Decreasing on-board fuel consumption in heat engine/battery electric hybrids by battery depletion. Wouk, V. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 13p. (CONF-780208—76).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Tests performed on three different configurations of hybrid vehicles establish that significant quantities of on-board petroleum fuel can be conserved by allowing the batteries to be discharged during the driving mission. The depleted batteries are then charged when the vehicle is not in use. Savings of as much as 50% of the on-board petroleum have been experienced with tests on the FDC. On SAE J227a, gasoline FE greater than 50 mpg was measured. Part of the energy for driving is thus transferred from on-board petroleum to offboard electricity generated from coal, hydroelectric or nuclear power plants, with no sacrifice in vehicle performance. The total energy used, when considering the replacement of energy to recharge the batteries, is analyzed. The results are favorable for the hybrid. A recommended new driving cycle for testing hybrids is discussed briefly.

VEHICLE DESIGN FACTORS

8549 Fairmont/Zephyr: engineered for lightweight and improved fuel economy. Gutherie, A.L. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 9p. (CONF-780208—14).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The engineering objectives for the new Fairmont/Zephyr carlines include: improved fuel economy by integrating aerodynamics into vehicle styling, reducing vehicle weight, and improving powertrain efficiencies, at no sacrifice of performance; maximum package efficiency by providing maximum passenger roominess within the car's compact exterior; and a comprehensive weight reduction program was initiated to improve fuel economy on the Fairmont/Zephyr carlines. New concepts in body and chassis design and selective usage of light-weight materials have resulted in a 245 lb. weight reduction versus 1977 Maverick. The car's structural strength, response, and durability have been verified by sophisticated computer techniques and extensive vehicle testing. To meet these objectives, it was necessary to design and develop a unitized body with maximum passenger roominess, new front and rear suspension, lighter and improved powertrain availability, and to determine application of lightweight materials. The design of these components and usage of lightweight materials to achieve reduced vehicle weight for improving fuel economy is discussed.

BODY AND CHASSIS

8550 Efficient vehicle packaging with front-wheel drive. Phillips, P.; Daniel, A.; Rebiffe, R. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 12p. (CONF-780208—16).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The search for improved packaging efficiency and flexible arrangements of available space has lead Renault to the use of front wheel drive. The development of four front wheel drive passenger cars at Renault is outlined and both similar and unique solutions adopted to achieve engineering and marketing objectives are illustrated. To obtain truly optimized designs for different sizes and classes of vehicles, it is very difficult to use common body and chassis components on several distinct car lines.

8551 Aerodynamic improvements: a great potential for better fuel economy. Janssen, L.J.; Emmelmann, H.J. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 9p. (CONF-780208—84).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Aerodynamic drag is one of the principal factors influencing fuel economy of passenger cars. Techniques are discussed which enable the effect of aerodynamic improvements to be evaluated utilizing computer simulation. Methods are also presented which enable such improvements to be realized. An acceptable drag coefficient of c/sub D/ = 0.42 can be readily achieved within conventional styling concepts by refining and optimizing body details. "Detail Optimization" can enable gasoline (diesel) powered vehicles to achieve maximum fuel economy improvements ranging between 4% (5%) and 7% (9%) above 1977 averages for subcompacts and full sized passenger cars respectively. Contemporary styling concepts placing great emphasis upon aerodynamics enable minimum drag coefficients of c/sub D/ = 0.32 to be achieved. Application of such concepts and techniques can enable fuel economy improvements of 14% (20%) for full sized passenger cars and 11% (14%) for subcompacts to be realized.

8552 Fundamental study on external engine noise propagation from light vehicles. Abe, E.; Kimura, A. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 17p. (CONF-780208—18).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The problem of engine noise propagation is analyzed. It was determined that there is a fundamental relationship between exterior noise and structural design. In the case of light vehicles, the following two factors in structural design which have a direct bearing on exterior noise are discussed: (1) the layout and the area of exposed openings in the engine room; and (2) the ability of the engine room to absorb noise. A comprehensive approach to the problem of automotive noise reduction is presented.

ENGINE-TRANSMISSION MATCHING

8553 1978 Chrysler torque converter lock-up clutch. Blomquist, A.P.; Mikel, S.A. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 9p. (CONF-780208—10).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A torque converter lock-up clutch was introduced by Chrysler Corporation in a majority of its passenger cars in the 1978 model year. The lock-up clutch improves fuel economy by eliminating torque converter slip in direct gear above a predetermined speed. The clutch and its controls were designed to fit within the confines of the existing transmission. The development of the clutch was primarily concerned with achieving adequate endurance life, good shift quality and isolation of torsional vibrations.

ENGINE SYSTEM

REFER ALSO TO CITATION(S) 8423, 8502, 8580, 8586

8554 (CONF-771175—, pp 6.2.1-6.2.6) **Flash boiling injection improves performance of methanol engines.** Suto, H.; Iwai, N.; Tsuruga, T.; Kim, Y.K.; Hirao, O. (Japan Automobile Research Inst., Inc., Ibaraki). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

This paper presents characteristics of flash boiling spray and its effects on improvement of performance of a spark ignition methanol cylinder injection engine. Superheated fuel in the injection nozzle is atomized on the instant of injection by boiling itself. This phenomenon is called flash boiling. Droplet size was measured using a direct microphotographic method in the open air. A single-cylinder engine was tested with flash boiling injection. The results are as follows: (1) flash boiling spray has very uniform droplet size distribution, and reduces the Sauter mean diameter to half as compared with normal high pressure spray. (2) thermal efficiency is increased and unburned methanol emission is decreased distinctly by means of flash boiling injection. Results show that flash boiling injection is a very effective fuel induction method to vaporize methanol and to form mixture, and that this method is available to improve performance of methanol engines.

8555 Design and development of the upper-pivoted sonic carburetor. Aquino, C.F. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 22p. (CONF-780208—37).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The two year design-development program for the sonic carburetor is reviewed. Use of the sonic nozzle as an air flow meter, and the design criteria to achieve low unchoke points is discussed. The relation between sonic flow and improved fuel atomization and A/F ratio distribution to the engine is also discussed. Unchoke data and A/F distribution data are presented, and the tradeoffs between low unchoke points and good A/F distribution are explained. Conclusions are drawn relative to the overall benefits of the sonic carburetor.

8556 Economic comparison of future automotive power systems. Mauri, G.; Fetterman, G.P. Jr.; Ricci, R.L. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 7p. (CONF-780208—40).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Exxon Enterprices Inc.'s approach to the economic evaluation of advanced automotive power systems is presented. Projected initial costs and operating costs for a subcompact car and a full size car powered by four different advanced power systems, i.e., an advanced spark ignition engine, a lightweight diesel engine, a battery

powered motor, and a diesel electric hybrid system are compared. The operating economics are based on a detailed analysis of the power system energy consumption. A proprietary computer program was used to simulate vehicle operation on a specific driving cycle and thus provide suitable energy consumption estimates. The initial and operating costs of the vehicles also reflect the different size and weight of the power systems, as well as weight propagation effects on the rest of the vehicle. For a meaningful comparison basis, each vehicle power system is sized to achieve an equivalent performance level (carrying capacity, acceleration capability, etc.), to the extent possible with motive components of vastly different characteristics.

8557 Overall design approach to improving passenger car fuel economy. Hanson, E.K. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 22p. (CONF-780208—15).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The critical challenge of improving fuel efficiency of new vehicles must be met if the world's finite petroleum supply is to be conserved for future generations. Automotive engineers will require new, more efficient design techniques to successfully meet the challenge. The approach used in the design of GM's new 1978 intermediates is given as an example of how improved efficiency can be achieved. Factors affecting fuel consumption are outlined along with program goal setting. Areas of emphasis including weight reduction, powertrain optimization, and road load horsepower reductions are discussed as well as explanations of new engineering tools used.

8558 Evaluation of restorative maintenance on exhaust emissions from in-use automobiles. White, J.T. III. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 21p. (CONF-780208—7).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The results of an automobile exhaust emission testing program conducted by the U.S. Environmental Protection Agency are presented. A total of 381 vehicles were subjected to a series of tests before and after various stages of tune-up. The vehicles were low-mileage 1975, 1976, and 1977 models of the three major domestic manufacturers and were obtained from private owners. Significant findings include the confirmation of the poor emission performance of newer vehicles when compared to their standards, the wide extent of maladjustments and disablements and the large emission reductions possible upon correction of these problems.

WEIGHT

REFER ALSO TO CITATION(S) 8557

EMISSION CONTROL

REFER ALSO TO CITATION(S) 8497, 8498, 8499, 8503, 8506, 8508, 8510, 8515, 8522, 8524, 8529, 8531

8559 Internal combustion engine equipped with catalytic converter. Yoshimura, T.; Kuroda, H. (to Nissan Motor Co. Ltd.). US Patent 4,099,377. 11 Jul 1978. Priority date 28 Apr 1975, Japan. 10p.

An internal combustion engine equipped with a catalytic converter for catalytically purifying the exhaust gases discharged from the combustion chambers of the engine is described. The oxygen-combustibles ratio of the exhaust gases introduced to the catalytic converter is normally controlled to a predetermined level suitable for the reaction within the catalytic converter in response to the composition of the exhaust gases upstream of the catalytic converter. However, the secondary air is continuously supplied to the catalytic converter regardless of the oxygen-combustibles ratio of the exhaust gases during cold start or warmup of the engine to rapidly raise the temperature within the catalytic converter to a level over which the catalytic converter effectively functions.

8560 Regeneration of hydrocarbon conversion catalysts. Wristers, J. (to Exxon Research and Engineering Co.). US Patent 4,098,833. 4 Jul 1978. Filed date 5 Nov 1976. 14p.

Hydrocarbon conversion catalysts comprising a metal halide in combination with a Bronsted acid containing fluorine that have become deactivated or partially deactivated by the formation of allyl and alkylaromatic carbonium ion complexes with the acid during contact with a hydrocarbon feedstock may be regenerated by contacting the catalyst, in the presence of molecular hydrogen and under suitable regeneration conditions, with a noble metal hydrogenation component. A preferred catalyst comprises tantalum pentafluoride and hydrogen fluoride. Palladium is the preferred noble metal hydrogenation component.

8561 Exhaust gas reactor for internal combustion engine. Bender, K.H. (to Bayerische Motoren Werke A.G., Muenchen (Germany, F.R.)). German(FRG) Patent 2,632,514/C/. 22 Jun 1978. 5p. (In German).

The construction of an exhaust gas reactor for internal combustion engines is described. According to the invention, the exhaust gas reactor is characterized in that there is a narrow gap between the single parts of the separating wall in order to prevent noise in case of gas oscillations of the heated exhaust gas.

8562 Effect of cold weather on motor vehicle emissions and fuel economy. Ostrouchov, N. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 16p. (CONF-780208—5).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The effect of soaking temperature on exhaust emissions was studied using a variety of automobiles representing three different emission control levels and testing them at ambients of 20°C down to -30°C(60°F to -22°F). It was found that emissions of the three gaseous pollutants demonstrated a mild power relationship with ambient (soaking) temperatures. All regulated pollutants and fuel consumption were higher at -30°C than at 20°C: hydrocarbons (HC)—3.5 to 9.2 times; carbon monoxide (CO)—2.4 to 6.4 times; oxides of nitrogen (NO/sub x/—only 1.1 to 1.4 times; and fuel consumption 1.2 to 1.8 times higher. Analysis of the data has indicated that HC and CO emissions from the cold start phase of the Federal test were the most sensitive to soaking temperature. With NO/sub x/ emissions the soaking temperature sensitivity was fairly constant throughout the three phases of the Federal test. The data also indicate that the temperature sensitivity of both fuel economy and, to a lesser extent, emissions is a function of inertia weight.

8563 Soak time effects on car emissions and fuel economy. Srubar, R.L.; Springer, K.J.; Reineman, M.E. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 19p. (CONF-780208—6).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Five light-duty vehicles were used to investigate HC, CO, and NO/sub x/ emissions and fuel economy sensitivity to changes in the length of soak period preceding the EPA Urban Dynamometer Driving Schedule (UDDS). Emission tests were conducted following soak periods 10 minutes to 36 hours in length. Each of the first 8 minutes of the driving cycle was studied separately to observe vehicle warm-up. Several engine and fuel system temperatures were monitored during soak and run periods and example trends are illustrated. The extent to which emission rates and fuel consumption are affected by soak period length is discussed.

8564 Relationship between local air-fuel ratio and combustion character in spark ignition engines. Ayusawa, T.; Nemoto, T.; Koo, Y.; Jo, S.H. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 17p. (CONF-780208—26).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A method to measure the air-fuel ratio at local points within the combustion chamber is described. The primary point is to obtain the pre-combustion air-fuel ratio of the mixture from the HC (vaporized fuel) and O_2 concentrations. This procedure which consists of three parts, gas sampling, gas transport and gas analysis, renders it possible to perform direct quantitative HC analysis of samples. This method is carried out by either of two techniques: multi-cycle sampling (MCS) and single cycle sampling (SCS), and the average air-fuel ratio of many engine-cycles and the single engine-cycle were obtained respectively.

8565 Effect of MMT on emissions from production cars. Lenane, D.L. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 22p. (CONF-780208—44).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Ethyl has been conducting extensive emission studies of two car fleets to investigate any effect of manganese antiknock (MMT) on exhaust emissions from production cars. One fleet has been operated for 50,000 miles on an EPA-type durability route. This fleet consists of thirty 1977 California cars—six cars each of five models (four U.S. and one import). Two of each model are using clear certification fuel, with two each using the certification fuel plus $^1/_{32}$ g Mn/gallon or $^1/_{16}$ g Mn/gallon. Although the test is still running, the 16 U.S. cars using clear fuel or $^1/_{16}$ g Mn/gallon have completed the 50,000 miles. For these cars, the average increase in HC, CO, and NO/sub x/ emissions was essentially the same for both the clear-fuel cars and the MMT cars, with deterioration rates being somewhat lower for the MMT cars. The second test involves 20 cars

from a large oil company fleet of 1975 and 1976 catalyst-equipped cars used by salemen in the field. Ten of the cars have used clear fuel and ten have used fuel containing 1/8 g Mn/gallon, with average mileage exceeding 50,000 miles. Engine-out emission data were obtained before and after deposit removal, and tailpipe emissions were measured as received and after tune-up. The engine-out data show only little differences in stabilized emission levels between the clear-fuel cars and the MMT cars, both before and after deposit removal. As-received tailpipe emission data showed a larger spread in individual car ratings, probably because of missing air-pump belts on some cars and other malfunctions of the air delivery system. Average tailpipe emissions after tune-up showed only small differences between the clear-fuel and MMT cars, with the difference in hydrocarbon emissions resulting from the abnormally high HC emissions of one MMT car.

8566 MMT plugging of oxidation catalysts on ceramic and metal supports during engine dyno studies of catalyst durability. Lichtenstein, I.E.; Mundy, J.P. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 11p. (CONF-780208—45).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

During engine dyno durability testing of oxidation catalysts, manganese deposition on the catalyst hot faces sufficient to affect catalyst performance for HC and CO conversions was observed. The severity of the problem is related to the MMT level in the fuel, the cell density of the catalyst's monolithic support, and engine aging time. The nature of manganese deposition in these studies and how it affects catalyst performance is explored. Apart from the MMT phenomenon, comparative studies of oxidation catalysts on conventional ceramic and high cell density, thin-wall metallic supports indicate that the latter offer significantly improved HC conversion durability.

8567 How MMT causes plugging of monolithic converters. Furey, R.L.; Summers, J.C. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 18p. (CONF-780208—46).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Monolithic oxidation converters can become plugged with manganese oxide deposits when the gasoline contains the antiknock additive MMT. Engine dynamometer studies showed that the rate of converter plugging depended on the catalyst inlet temperature and the concentration of MMT in the fuel. Converter plugging was not affected by base fuel or engine oil composition, and it occurred as readily with a bare monolithic support containing no catalytic material as with a production catalyst. Monolithic converter plugging appears to be a physical, rather than a chemical phenomenon, in which the manganese oxide collects primarily on the inlet edge of the converter.

8568 Fast burn with heavy EGR, new approach for low NO/sub x/ and improved fuel economy. Kuroda, H.; Nakajima, Y.; Sugihara, K.; Takagi, Y.; Muranaka, S. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 17p. (CONF-780208—47).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

In the way to seek a marked reduction of NO/sub x/ just by EGR which was proved to be the best answer from the past studies, this analytical study deals with combustion around the practical engine stability limit. The results show that practical engine operating stability limit with the four cylinder engine is determined by the occurrence of several percent of slow burn. Experiments applying short combustion duration (fast burn) showed that the fast burn in combination with heavy EGR improves engine stability and has a potential to achieve substantial reduction in NO/sub x/ emission along with some improvement in fuel economy. This potential was also directed by mathematical model study. This fast burn concept was embodied in the newly developed Nissan Z Fast Burn Engine.

8569 Spectroscopical determination of temperature- and OH-concentration distribution in the combustion chamber of an Otto-engine. May, H.; Mueller, W. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 8p. (CONF-780208—87).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Spectroscopic investigations of the combustion process in spark ignition engines were performed with the aid of the band head of the OH-band system at 306.4 nm. Using an optical probe system the course of the emission-absorption-temperatures and OH-concentrations at different combustion chamber positions could be detected. The experimental results are related to those calculated by use of a theoretical model describing the change of the thermodynamic and chemical state of the gas. Additional measurements were executed at a combustion chamber of constant volume.

8570 Exhaust train materials for current Japanese auto-manufacturers. Ohsawa, M.; Hagiwara, Y. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 15p. (CONF-780208—85).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

In the Japanese automotive industry considerable changes have been made in, not only design of exhaust train, but also materials to be used due to non-leaded gasoline as well as emission controls. The application of heat-resisting materials and stainless steel has increased rapidly and at the same time manufacturing techniques and performance improvement of raw-materials have been made for heat-resisting steel for passenger cars. The current trend in materials used for exhaust train such as reactor, catalytic converter, other parts of the exhaust train, engine valves, valve seat inserts is discussed.

8571 Exhaust emission capabilities of showroom cars. Gullon, A.C. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 8p. (CONF-780208—8).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A statistical analysis of emission test results from over 200 light duty production vehicles ('72 to '77 models) which were purchased, maintained (in a very good state of tune), driven (on Appendix "IV" routes), and tested by the Canadian government is presented. The results are presented as fractions of the applicable emission standard by manufacturer and by model year. Some limited data on urban fuel economy is also presented. The results would be useful in analyzing engine design policy and to assist in policy making for emission control programs for in-use vehicles.

CARBON MONOXIDE

8572 Water—gas shift and steam reforming reactions over a rhodium three-way catalyst. Schlatter, J.C. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 6p. (CONF-780208—107).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

Under oxygen-deficient (rich) conditions, a potential route to maintaining control of carbon monoxide (CO) and hydrocarbon (HC) emissions in a three-way system is through reactions of these pollutants with water vapor (H_2O). The importance of such reactions over supported rhodium was investigated in the laboratory. The water-gas shift ($CO + H_2O$) was insignificant. Steam reforming ($HC + {}^2H_2O$) took place, but gave CO as a product. Thus, if CO conversion governs the rich-side effectiveness of a three-way catalyst, steam reforming which converts HC to CO is unlikely, in itself, to improve three-way performance.

HYDROCARBONS

REFER ALSO TO CITATION(S) 8513, 8572

8573 Sources of hydrocarbon emissions in rotary engines. Burley, H.A.; Meloeny, M.R.; Stark, T.L. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 18p. (CONF-780208—38).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

In many rotary engines, over 10% of the fuel passes through the engine unused. This loss makes exhaust cleanup difficult and also represents a serious penalty in fuel economy. The major hydrocarbon sources were found to be apex seal leakage, cold wall zone effects, residuals and surface-to-volume ratio which included rotor surface quench and chamber surface quench. Lesser hydrocarbon sources were crevice volume, and effects attributable to spark plug, ignition system, turbulence, intake mixture and lubricant on the combustion chamber walls. Through various engine modifications we were able to cut base engine hydrocarbons about 55%.

8574 Observation of flow characteristics in a model I.C. engine cylinder. Ishikawa, N.; Daily, J.W. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 10p. (CONF-780208—87).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

A study of fluid mechanics effects on unburned hydrocarbon generation was made in a single compression-expansion model automobile engine. Full optical access allowed color schlieren observations of gas motion inside the engine cylinder. Motion pictures of the gas motion and flame propagation were taken at a rate of seven

thousand frames per second for the following cases: (1) intake stroke; (2) exhaust stroke; and (3) compression power stroke with combustion and blowdown with appropriate exhaust valve opening. Unburned fuel concentrations were measured by means of a gas chromatograph. The results showed that turbulent motion of the mixture increases the amount of unburned fuel. It is implied that the rolled-up vortices play an important role on wall flame quenching processes in an engine.

ALTERNATIVE FUELS

REFER ALSO TO CITATION(S) 7339, 7345, 7579, 7607, 7608, 7609, 7610, 7611, 7612, 7613, 7614, 7615, 7616, 7617, 7619, 7620, 7626, 7627, 8414, 8554

8575 (CONF-771175—, pp 2.6.1-2.6.9) **Methanol effects on lubrication in engine wear.** Owens, E.C. (Southwest Research Inst., San Antonio, TX). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

This paper reports the effects of methanol and methanol-gasoline fuel blends on wear and deposit formation in conventional S.I. engines. The work to date indicates that during periods of low-temperature engine operation, methanol and its combustion products, when reacted with the lubricant through blowby, increases the rate of wear of the piston rings and cylinder bore significantly during short-term testing. Evidence also indicates possible incompatibility with conventional lubricant additive packages resulting in diminished engine protection and precipitation of additive components. Plans for ongoing and future work leading to development of lubricants for use with alcohol-containing fuels are outlined.

8576 (CONF-771175—, pp 4.2.1-4.2.7) **Alternate air-fuel induction system contrasts in terms of fuel economy and exhaust emissions for simulated driving cycles with methanol and indolene.** McCormack, M.C.; Pefley, R.K. (Univ. of Santa Clara, CA). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

An experimental investigation of a 4-cylinder 2.3L spark ignition engine was undertaken to examine steady-state performance, fuel economy, and exhaust emissions while operating on methanol. Five configurations of intake manifold-fuel induction systems were examined. One provided baseline results using Indolene while the other four provided comparative results using methanol. The steady state results were then utilized as inputs to a computer program which predicted fuel economy and emissions for the U.S. EPA urban and highway driving cycles. For an idealized case of overall constant equivalence ratio throughout the speed and load range on cylinder-to-cylinder variations (no maldistribution) the results showed that two of the systems could meet the original U.S. statutory emission standard of 0.4 g/mi NO/sub x/ at an equivalence ratio of Phi = 0.7. In addition, gains were seen in fuel economy (energy base) for all the methanol fueled systems ranging between 6 and 30 percent in the urban cycle and between 10 and 30 percent in the highway cycle in comparison to the baseline results on Indolene. One novel fuel-air induction system which eliminates cylinder-to-cylinder variations in equivalence ratio is described. In addition, a maldistribution index which relates cylinder-to-cylinder variations in equivalence ratio to penalties in power and thermal efficiency is introduced.

8577 (CONF-771175—, pp 4.3.1-4.3.7) **Comparison of gasoline, methanol, and a methanol/water blend as spark ignition engine fuels.** Johnson, R.T. (Univ. of Missouri, Rolla). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Indolene gasoline, methanol, and methanol + 5 percent water (M5W) were tested in a single cylinder spark ignition engine to determine their influence on power, efficiency, and exhaust emissions. Methanol and M5W fuels exhibited efficiency increases of 2 to 3 percent for the range of test conditions. At equal intake mixture temperatures, methanol and M5W produced 5 to 7 percent less power output than Indolene. For constant manifold heat conditions (substantially lower mixture temperatures), methanol and M5W produced 5 to 7 percent more power than Indolene. Peak NO/sub x/ emissions were reduced 30 to 40 percent with methanol and 45 to 60 percent with M5W over the Indolene reference fuel. Mass specific CO emissions were essentially unaffected by fuel type. Mass specific emissions of unburned fuel (UBF) were comparable for Indolene and methanol at all test conditions. Indolene, methanol and M5W exhibited comparable UBF emissions for constant mixture temperature. For the cooler mixture temperatures at constant manifold heat conditions, the M5W fuel demonstrated substantially increased UBF emissions.

8578 (CONF-771175—, pp 4.4.1-4.4.19) **Exhaust behavior of Otto-type and layer charge engine in operation with methanol.** Gruden, D.; Hochsmann, G. (F. Porsche A.G., Weissach, Ger.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The possibilities of using methanol in various combinations with gasoline are tested in an Otto-type engine, an engine with lean fuel-air mixture and a stratified-charge engine. From the standpoint of combustion there is nothing to inhibit the use of methanol in a combustion engine. Methanol exerts the largest influence on the course of combustion in the Otto-type engine and the Otto-type engine with lean fuel-air mixture. Output and efficiency rise, the exhaust emission of the legally limited components is reduced. During the combustion of lean fuel-air mixtures in all engines, especially a marked reduction of the NO/sub x/-emissions was determined in comparison to gasoline.

8579 (CONF-771175—, pp 4.5.1-4.5.8) **Stratified charge in a single chamber engine using methanol.** Ito, K. (Hokkaido Univ., Sapporo); Kajitani, S.; Fukazawa, S. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

A stratified charge by means of direct auxiliary fuel injection has been studied with a single chamber engine for the purpose of reduction of NO emissions without a great sacrificing of fuel economy. The single cylinder S.I. engine was operated with wide open throttle at engine speed of 1500 rpm, using a special shrouded spark plug as well as a conventional plug. Emissions and a number of engine performances were measured for various injection directions, overall equivalence ratios and injection rates, and for different values of injection ratio and injection timing. The results indicated that successful stratification was obtained with the auxiliary injection directly to the vicinity of the spark plug. Also the main fuel was carbureted. A reduction of over 50 percent NO emission was attained while maintaining the same thermal efficiency in comparison with nonstratified charge. This technique could not be applied to the use of gasoline fuel because of spark plug fouling.

8580 (CONF-771175—, pp 6.1.1-6.1-10) **Development of methanol and petrol carburation systems in the Netherlands.** van der Weide, J.; Ramackers, M.W.A. (TNO Research Inst. for Roadvehicles, Delft, Netherlands). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Carburation systems for methanol tend to become rather complex due to the fact that a higher amount of the fuel has to be carburated together with the fact that the heat of evaporation is very high. The problems arise particularly with respect to the driveability and the cold start. Also the storage of a methanol/petrol mixture aboard the vehicle is difficult when the methanol content exceeds 15 percent. The research and development work in the Netherlands regarding hardware development to meet their problems will be presented. Besides a general review of systems, one system with the following characteristics will be described in particular: Injection system, electronically controlled sensing the air speed in the carburetor, capable of handling different methanol/petrol ratios with minimized dimensions, so that retrofit in existing vehicles is possible.

8581 (CONF-771175—, pp 6.4.1-6.4.6) **Predicted methanol-water fuelled SI engine performance and emissions.** Browning, L.H.; Pefley, R.K. (Univ. of Santa Clara, CA). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Compression ratio and liquid water addition effects on performance and emissions of a methanol-fueled SI engine were studied using a combustion kinetics computer model which incorporated two different cylinder head geometries (flat head and squish chamber). Earlier experimental work by two independent research workers had shown that volumetric NOx emissions decreased when compression ratio was increased from 9.7:1 to 14:1 at MBT spark settings. The flat head computer model, however, predicted a continual increase in volumetric NOx emissions for increasing compression ratio at MBT spark timing. With only a 3° retard from MBT,

the computer predicted volumetric NOx emissions at 14:1. Compression ratio was reduced to that at 8.44:1 compression ratio and MBT spark timing. With this spark retard setting, there was a net increase in power and thermal efficiency of 13.7 percent relative to the MBT values at 8.44:1 compression ratio. Contrastingly, the "squish" chamber computer model predicted a drop in volumetric NOx emissions by raising the compression ratio from 8.44:1 to 14:1 at MBT spark timing. This decrease in NOx emissions was due to increased turbulence caused by the changing cylinder head geometry as the compression ratio increased. The effects of adding various percentages of liquid water to methanol were also examined. They showed an 84 percent reduction in NOx emissions with a slight gain in power and thermal efficiency by using a 30 percent water—70 percent methanol mixture instead of 100 percent methanol at the same equivalence ratio and compression ratio.

8582 (CONF-771175—, pp 7.5.1-7.5.17) **Concerning the starting and driving behavior of methanol-containing fuels.** Nierhauve, B. (ARAL Research/Application, Bochum, Ger.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Methanol as an additive to Otto-type fuels changes the fuel volatility markedly with its chemico-physical properties and thus the starting and driving behavior of vehicles. Prior to the introduction of methanol-containing fuels, therefore, thorough knowledge concerning these influences is necessary. An experimental and evaluation process developed by ARAL Research and Application permits the characterization of the starting and driving behavior with good repeatability and comparability. According to this method, experimental series have been driven with methanol-containing mixed fuels and usual fuels of varying volatility and composition in series-built vehicles at high and low environmental temperatures on the road as well as in climate-controlled car teststands. Methanol-containing fuels cause a worsening of the driving behavior at high environmental temperatures and/or operation on high-altitude roads in comparison to fuels of present production. The differences are not as pronounced in cold temperatures, methanol-containing fuels can under certain circumstances even behave better.

8583 (CONF-771175—, pp 7.6.1-7.6.14) **Operation of Otto-type engines on gasoline-methanol/water.** Starke, K. (BASF A.G., Ludwigshafen, Ger.). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The utilization of methanol/water mixtures as highly knock-free components in combination with hydrocarbons of low knock-resistance, requires the use of two separate fuel systems in a vehicle. In this process, mixtures capable of being ignited are formed from the individual fuels and then mixed with each other only in the intake manifold. The two-component system permits the production of total-fuel-air mixtures with variable knock resistance, that can be adapted to the octane number requirement of the engine for any operational condition. The two-component operation offers the possibility of using highly knock-free and therefore more expensive fuels only when this is required on the part of the engine. The addition of water to the combustion, on the one hand, effects an increase in the motor octane number values of the fuel-air mixture and, on the other hand, reduces the emission values for nitrous oxide. Experimental results from test stand and driving studies with a VW vehicle are presented.

8584 (CONF-771175—, pp 7.7.1-7.7-9) **Methanol and ethanol as raw materials for the synthesis of high octane components.** Garibaldi, P. (Snamprogetti S.p.A., Milan); Pecci, G.; Vicenzetto, F.; Razze, S. Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

Considering the problems which have still to be solved before the direct utilization of alcohols, the use of methanol and ethanol as raw materials for the synthesis of MTBE (methyl-tert-butyl ether) and ETBE (ethyl-tert-bytyl ether) seems extremely promising. These ethers, having a high blending ON, are not associated with any of the problems typical of the alcohol gasoline mixtures (water solubility, formation of azeotropic mixtures, high heat of evaporation, corrosion, etc.). This paper deals with the chemical, physical and knock characteristics of ether/gasoline blends. It shows performance and emission results obtained on engine bench and vehicle road tests, using fuel blends containing up to 20 percent of ether. It further describes the process of manufacturing the two ethers starting from methanol or ethanol and isobutylene. Based on present availability of isobutylene, the theoretical production capacity of MTBE and ETBE in the industrialized countries has been assessed.

8585 (COO—4486-3) **Flame propagation, autoignition and combustion in alcohol-petroleum-air mixtures and other alternative fuels. Progress report No. 3, August 1, 1977—July 31, 1978.** Henein, N.A. (Wayne State Univ., Detroit, MI (USA)). Jun 1978. Contract EC-77-S-02-4486. 11p. Dep. NTIS, PC A02/MF A01.

Due to the energy crisis, petroleum-derived gasoline and other distillates may be replaced in the future by such alternative fuels as alcohols, alcohol-petroleum blends and coal and shale oil derivatives. The main goal of this program is to determine the combustion characteristics of these alternative fuels in gasoline, diesel, and gas turbine engines so that future combustion engines may be designed for the best energy conversion and minimum emissions. The approach consists of studying the process of combustion in actual engines to obtain data needed to either design new engines or modify and adapt existing engines to the alternative fuels. This includes both experimental and theoretical work. The experimental work consists of instrumenting and running tests on three research engines and measuring the following combustion characteristics: (a) motor octane number of the fuel, (b) flame speed, (c) flammability limits, (d) cycle-to-cycle variations, (e) emissions, (f) performance parameters, such as power and economy, (h) ignition delay, and (i) cetane number of the fuel. The present cetane scale has been evaluated during this program and found unsuitable to rate the low ignition quality fuels and many alternative fuels. Work on this contract resulted in developing a new modified scale that is suitable for rating all fuels. The theoretical work includes (a) calculating and correlating the flame speed with different fuel properties and engine operating parameters, (b) determining the effect of turbulence, (c) correlating the ignition delay with air and fuel properties, (d) characterizing the fuels by determining the global activation energy for the autoignition reaction, and correlating it to the cetane number of the fuel, and (e) studying in detail the combustion parameters used in the cetane scale.

8586 **Four-octane-number method for predicting the anti-knock behavior of fuels and engines.** Douaud, A.M.; Eyzat, P. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 15p. (CONF-780208—9).

From Society of Automotive Engineers International Automotive Engineering Congress and Exposition; Detroit, MI, USA (Feb 1978).

The "Four-Octane-Number Method" is a practical determination of the knock-resistance of fuels based on the autoignition delay concept and obtained through simple processing of the standard "Research" and "Motor" indices combined with two other indices specially defined. The knocking behavior of any engine can be specified once by measuring its octane requirement with 2 fuels for which the four octane numbers are known. The behavior of any fuel can be predicted without experimenting on all the engines thus identified if its four octane numbers are known. Extensive controls of the method have been performed over about 1000 samples for which the road octane numbers were measured. The method's predictions are within an average accuracy of 0.5 octane point.

MATERIALS

8587 (UCRL—81159(Rev.1)) **Evaluated physical properties data for materials used in energy storage systems.** Hampel, V.E.; Gevantman, L.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1978. Contract W-7405-ENG-48. 29p. (CONF-780587—5). Dep. NTIS, PC A03/MF A01.

From 6. CODATA conference; Palermo, Italy (22 May 1978).

Communication of up-to-date, accurate information is the key issue in our highly competitive society. It is especially important for newly emerging technologies where administrators and engineers are confronted with materials and operating conditions for which comprehensive bodies of data may not exist. A start has been made by the DOE Division of Energy Storage Systems in the implementation of a data evaluation program at the Lawrence Livermore Laboratory. It is being conducted in collaboration with the Office of Standard Reference Data at NBS. Evaluations of material properties, specified by the users, are prepared by specialists, organized and compiled. Results are published periodically in a new series of standard reference data for energy storage by NBS. The data are also delivered to LLL where they are entered into an automated Integrated Information System. This computer-based system now consists of a growing number of relevant data bases. In addition to material properties, national panels of experts from DOE laboratories and from industry quantify the efficiencies and costs of composite energy storage systems, which are also made part of the data base collection at LLL. Models and analyses programs complement the data and support the reliable achievement of short-term and long-term objectives for DOE/STOR.

METALS AND ALLOYS

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 7207, 7355, 7566, 7827, 8598, 8678, 8783

8588 (CONF-780834—5) **Solidification behavior of type 308 stainless steel filler metal.** David, S.A.; Goodwin, G.M. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 9p. Dep. NTIS, PC A02/MF A01.

From 5. Bolton Landing conference; Lake George, NY, USA (27 Aug 1978).

A series of experiments that combined thermal analysis and interrupted solidification was carried out to understand the solidification behavior of type 308 stainless steel weld metal. Results indicate the following sequence of phase separations for the alloy investigated: L → L + delta → L + delta + γ → γ + delta. Ferrite observed at room temperature was identified as the untransformed primary delta-ferrite that formed during the initial stages of solidification. The mode of freezing and the extent of solid-state diffusion both control the amount and distribution of ferrite. Microstructural and microprobe analyses indicated both extensive solid-state transformation and solute redistribution during solidification and cooling from the nonequilibrium solidus to room temperature.

8589 (UCRL—13878) **Study to assess the feasibility of scaling up the powder metallurgy approach for the fabrication of commercial Nb_3Sn filamentary superconductors.** (Magnetic Corp. of America, Waltham, MA). 9 Dec 1977. Contract W-7405-ENG-48. 21p. Dep. NTIS, PC A03/MF A01.

Portions of document are illegible.

A preliminary assessment was made of the feasibility of scaling up the laboratory techniques of making filamentary Nb_3Sn superconductors using powder metallurgy to commercial fabrication process. The purpose of the effort is divided into two tasks. The first one is to demonstrate that sintered niobium rods infiltrated with tin can be reduced in area of approximately 10^4. The second task pertains to the extrusion by conventional manner a copper billet containing several sintered rods each encapsulated in tantalum. The ultimate goal of the project is to establish optimal processing parameters that are suitable for the production of long lengths of fully stabilized, large current and high field conductors.

8590 **Difficulties in producing pure α-phase plutonium.** Sandenaw, T.A. (Univ of Calf, Los Alamos Sci Lab, NM). *J. Nucl. Mater.;* **73**: No. 2, 204-207(May 1978).

Repeated cycling within the temperature range between 298 K and 373 K, where the diffusion controlled $\beta \rightarrow \alpha$-phase transformation takes place, appears to be one way of producing pure α-Pu.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 8588, 8598, 8599, 8605, 8617, 8772

8591 (BNL—24264) **Magnetic excitations and the cooperative Janh—Teller transition in $PrCu_2$.** Kjems, J.K.; Ott, H.R.; Shapiro, S.M.; Andres, K. (Brookhaven National Lab., Upton, NY (USA)). [nd]. Contract EY-76-C-02-0016. 11p. (CONF-780824—4). Dep. NTIS, PC A02/MF A01.

From 15. conference on low temperature physics; Grenoble, France (23 Aug 1978).

The structural distortion in $PrCu_2$ below the Jahn-Teller transition at T/sub D/ = 7.3 K was measured by neutron diffraction. The primary order parameter was found to be the e/sub zx/ strain of the orthorhombic unit cell. The coupling of this strain to the lowest two crystal field levels gave rise to the dominant quadrupole interaction between the Pr^{+3} ions. A dipole transition to the second excited crystal field level was also observed. The dispersion of this excitation shows that the exchange interaction is antiferromagnetic, consistent with the enhanced antiferromagnetic nuclear ordering reported below 52 mK.

8592 **Reviews on the deformation behavior of materials.** Feltham, P. (ed.). Israel; Freund Publishing House Ltd. (1977). 95p.

Unusual mechanical behavior, associated with martensitic phase-transformations, and certain related effects are currently of increasing interest; their study comprises a comparatively new area of research into the deformation behavior of crystalline materials. One such phenomenon is pseudoelasticity, in which relatively large strains, attained on loading beyond the elastic limit, recover completely on unloading at a constant temperature. This is reviewed in detail. For convenience in description, pseudoelastic behavior has been subdivided into two categories: superelasticity and the rubber-like effect, depending on the nature of the driving forces and the mechanisms involved. If the behavior is caused by a stress-induced martensitic transformation and its subsequent reversion, the terminology "superelasticity" is used. Commonly realized by a transformation between parent and martensitic phases in thermoelastic alloys, the superelastic effect is discussed in detail, i.e., its principal characteristics and variables. It is emphasized that superelasticity can also occur through a stress-induced transformation and reversion between two martensitic phases, as has recently been observed. "Rubber-like behavior," which is generally indistinguishable from superelasticity on the basis of stress-strain curves alone, is descriptive of behavior characteristic solely of the martensitic phase in a few alloys, and does not involve a phase transformation. It is characterized by twin and/or intervariant boundary-motion and a relaxation process, but the nature of the driving force and of the mechanism are rather obscure. Some pertinent experimental results, and several suggested mechanisms for rubber-like behavior are critically discussed. The general conclusion evolves that while superelasticity is reasonably well understood, rubber-like behavior is not. 163 references.

8593 **Observation of low-frequency excitations of deuterium and hydrogen in niobium.** Shapiro, S.M.; Noda, Y.; Brun, T.O.; Miller, J.; Birnbaum, H.; Kajitani, T. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev. Lett.;* **41**: No. 15, 1051-1054(9 Oct 1978).

Measurements of the dispersion curves on single crystals of NbD/sub 0.85/ and NbH/sub 0.82/ reveal two new excitations at $\hbar\omega$ = 18.4 and 10.8 meV. The positions of these excitations are independent of temperature and mass of the light atom, but the linewidth is broader in the α' solid-solution phase than in the β phase, and broader in the hydrogen system than in the deuterium system.

8594 **Phonon softening of Nb_3Sn in [zetazetazeta]T modes.** Shirane, G.; Axe, J.D. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev., B;* **18**: No. 7, 3742-3745(1 Oct 1978).

Neutron scattering measurements have been extended to the [zetazetazeta] transverse branch of Nb_3Sn. In contrast to the prediction of Gor'kov, this branch also shows a pronounced phonon softening. We conclude that all phonon branches in Nb_3Sn exhibit softening for a wide range of q towards the martensitic transition at 45 K.

8595 **Fermi surface of platinum.** Dye, D.H. (Northwestern Univ., Evanston, IN); Ketterson, J.B.; Crabtree, G.W. pp 70-74 of Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Inst. of Physics (1978).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

The two high-mass (epsilon, β) orbits on the open hole surface of platinum, not observed in previous de Haas—van Alphen studies, have now been measured. A non-muffin-tin relativistic phase shift fit to the extremal areas and effective masses has been used to determine the Fermi radii and velocities on all surfaces.

8596 **Soft x-ray emission spectra of Cu/sub c/Ni/sub 1-c/ alloys.** Durham, P. (Univ. of Bristol, Eng.); Gyorffy, B.L.; Hague, C.; Stocks, G.M.; Temmerman, W.M. pp 405-410 of Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Inst. of Physics (1978).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

The L_3 soft x-ray emission spectra of various Cu/sub c/Ni/sub 1-c/ random alloys were calculated using the KKR-CPA theory. The results are compared with the results from experimental measurements. (GHT)

8597 **Structure determination using EXAFS in real space: Ge.** Hayes, T.M. (Xerox Palo Alto Research Center, CA); Sen, P.N.; Hunter, S.H. *J. Phys., C (London);* **9**: 4357-4364(1976).

The Fourier transform, phi (r), of the EXAFS is expressed as the convolution of a structure factor and a scattering factor, xi (r). It is shown that the xi are long range and sharply oscillatory, so that the interference of neighboring shells can substantially hinder the determination of structural information from phi. A procedure to localize the phi without significant loss of spatial resolution is recommended. This reduces the interference and enables the extraction of the scattering signal of a single shell of atoms. The local environment of the excited core then follows directly from a simulation of the complete phi. This analysis is illustrated with crystalline Ge. 3 figures, 1 table.

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 7562, 7581, 7582, 7583, 7585, 8035, 8037, 8038, 8039, 8592, 9365

8598 (CONF-770735—4) **Self-welding evaluation of stellite 6 and stellite 156 in flowing sodium.** Chang, J.Y.; Schrock, S.L.; Johnson, R.N. (Westinghouse Electric Corp., Madison, PA (USA).

Advanced Reactors Div.). 1977. Contract EY-76-C-02-3045-001. 31p. Dep. NTIS, PC A03/MF A01.

From International Metallographic Society annual meeting; Houston, TX, USA (19 Jul 1977).

The self-welding behavior of two similar materials, Stellite 6 and Stellite 156, in sodium are discussed. The materials were tested at temperatures from 850 to 1140°F for time periods up to six-months while immersed in flowing sodium. Contact stresses ranged from 6000 psi to 16,000 psi on contact areas from 0.35 to 0.47 square inches. All separation tests to determine the extent of self-welding were conducted in a tensile mode. The surface morphologies of the samples before and after each test were measured. At temperatures of 1115°F and above, almost all the Stellite 6 specimens indicated a significant tendency toward self-welding within a relatively short period of time (one week). Stellite 156 couples also developed a strong self-weld bond at 1060°F after six-month exposure.

8599 Volume dependence of the elastic properties of bcc transition metals. Katahara, K.W. (Univ. of Hawaii, Honolulu); Manghnani, M.H.; Fisher, E.S. pp 414-417 of Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Inst. of Physics (1978).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

The elastic moduli and their volume derivatives in BCC early transition metal alloys show a composition dependence which appears to be consistent with the rigid band model in that marked changes are observed at compositions where changes in the Fermi-surface topology are predicted.

8600 Thick-plate technique for measuring ejecta from shocked surfaces. Asay, J.R. (Sandia Laboratories, Albuquerque, New Mexico 87115). *J. Appl. Phys.;* **49**: No. 12, 6173-6175(Dec 1978).

An experimental technique is discussed for measuring the mass-velocity distribution of material ejected from strongly shocked surfaces. The two major advantages of this technique are, first, that it is useful for measuring large amounts of surface ejecta and, second, that it allows a direct determination of the mass-velocity distribution of ejecta, without the need for differentiating experimental data. The method has been applied to a measurement of surface ejecta from shock-loaded porous tungsten.

8601 Penetrated fatigue crack opening displacement and growth rate under combined tensile and bending loading (failure analysis step III). Toyosada, M.; Nagai, A. *Hitachi Zosen Giho;* **39**: No. 2, 54-63(Jun 1978).

The crack opening displacements (COD's) and growth rates of penetrated through-thickness crack under combined tensile and bending stresses were studied. The COD's can be calculated using an idea of "equivalent stress" and the growth rates can be related to Paris' law by considering the COD's. 20 figures.

8602 Influence of sodium environment on the uniaxial tensile behavior of titanium modified type 316 stainless steel. Natesan, K.; Chopra, O.K.; Kassner, T.F. (Argonne Natl Lab, Ill). *J. Nucl. Mater.;* **73**: No. 2, 137-150(May 1978).

True stress-true strain tensile data have been obtained for titanium-modified type 316 stainless steel in the solution-annealed condition and after exposure to a flowing sodium environment at temperature of 700, 650, 600 and 550°CC. The specimens were exposed between 120 and 5012 h to produce carbon penetration depths in the range 0.05-0.30 mm. When compared with solution annealed specimens, the tensile flow behavior of the sodium-exposed specimens is characterized by a higher strain hardening rate, which decreases rapidly as the flow stress increases. The loss in tensile ductility of the material due to carburization in sodium environment was minimal.

8603 Notch toughness study of welded ship plate for the floating nuclear plant. Arbiter, W.; Opoku, J. (Offshore Power Syst). *Offshore Technol. Conf.;* **2**: 893-908(1978).

A test program was undertaken to establish fracture toughness properties of ABS Grade CS steel plate and of weldments made in the plate using a number of the processes to be employed in the production of floating nuclear plant (FNP) platforms. Chemistry, tensile properties, grain size, and microstructure were determined for all 12 plates. The results of this phase indicated that four of the plates failed to meet the DW nil ductility temperature (NDT) requirements - no break at -30°F.

8604 Analysis of thin films in an electron probe. I. Remarks on measurement techniques for thickness determination. Hofer, W.O. (MPI fuer Plasmaphysik, Garching, Ger.). *Mikrochim. Acta, Suppl.;* No. 7, 185-196(1977). (In German).

The thickness of thin metallic films on different substrates was determined by means of electron induced x-ray excitation. In order to achieve maximum performance, this universally applicable method requires careful optimization of experimental parameters and instrumental settings. For given film-substrate combinations the excitation energy, the energy of the registered quanta, the spectrometer setting and differential pulse height discrimination are of decisive influence on the detection limit, sensitivity, and measuring range. Additional enhancement in sensitivity can be achieved by artificially increasing the excitation density in the layer by means of enhanced scattering of electrons in the surface, by electron backscattering from the substrate or by a special method of data acquisition which also includes the influence of electron backscattering by the thin film. The contribution by the bremsstrahlung continuum from the film can also be used to advantage.

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 8031, 8636, 8684

8605 Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Institute of Physics (1978). 763p. (CONF-770827—).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

Topics covered include: electronic structure and physical properties of bulk metals; the physics of transition metal clusters and surfaces; lattice vibrations and the electon-phonon interaction, especially in relation to superconductivity; and ferromagnetism, exchange-enhanced paramagnetism and antiferromagnetism of itinerant electrons. Abstracts of individual papers presented at the conference were prepared for the data base. (GHT)

8606 (CONF-780952—8) **Kirkendall voids: a detriment to Nb_3Sn superconductors.** Easton, D.S.; Kroeger, D.M. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

Multifilamentary composites with constant Nb/bronze ratio were heat treated for a range of reaction times. With increasing reaction time, the size of diffusion (Kirkendall) voids in the bronze matrix increases, as does the Nb_3Sn layer thickness. Because of the resultant changes in mechanical and superconducting properties, the strain at onset of degradation of critical current density, J/sub c/, decreases with increasing reaction time. Thus there is a compromise between strain sensitivity and current capacity at zero strain as reaction time is increased. For strains on the order of 0.2 to 1.0%, the increased strain sensitivity of J/sub c/ in specimens which were reacted for longer than approximately 24 hrs offsets the gain in J/sub c/ resulting from increased Nb_3Sn layer thickness. The diffusion voids are also related to thermal instabilities and crack initiation.

8607 Anomalous temperature dependence of the electric-field gradient at ^{181}Ta impurities in holmium: Influence of host 4f crystalline-field levels. Rasera, R.L.; Dunlap, B.D.; Shenoy, G.K. (Department of Physics, University of Maryland, Baltimore County, Baltimore, Maryland 21228). *Phys. Rev. Lett.;* **41**: No. 17, 1188-1191(23 Oct 1978).

Measurements of the electric quadrupole interaction at ^{181}Ta impurities in paramagnetic Ho metal using time-differential perturbed angular correlations show marked deviation from the usual T/sup 3/2/ behavior. A phenomenological theory applied to this and other cases of closed-shell probes in rare-earth metals indicates that the deviation is due to the aspherical charge distribution of the host ion arising from the influence of the crystalline electric field on their unfilled 4f shells.

8608 Lithium-oxygen donor in germanium: A dynamic tunneling system. Haller, E.E.; Falicov, L.M. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Phys. Rev. Lett.;* **41**: No. 17, 1192-1194(23 Oct 1978).

High-resolution spectra of the lithium-oxygen donor in pure germanium under uniaxial stress are reported for the first time. They can be unambiguously interpreted in terms of a molecular-complex donor with $<111>$-type symmetry and tunneling between all four possible orientations.

8609 Coexistence of antiferromagnetism and superconductivity: A neutron diffraction study of $DyMo_6S_8$. Moncton, D.E.; Shirane, G.; Thomlinson, W.; Ishikawa, M.; Fischer, O. (Bell Laboratories, Murray Hill, New Jersey 07974). *Phys. Rev. Lett.;* **41**: No. 16, 1133-1136(16 Oct 1978).

Although $DyMo_6S_8$ is a superconducting below T/sub c/ = 2.05 K previous studies of the resistivity, susceptibility, and upper critical field strongly suggest the development of magnetic order at T/sub M/ = 0.4 K. The present neutron study shows conclusively that this superconducting compound also develops coexistent long-range (greater than 300 A) antiferromagnetic order at T/sub M/. The Dy atoms form a simple cubic sublattice (with a slight rhombohedral distortion) in which the observed magnetic structure consist-

ing of (100) planes with moments of 8.77μ/sub B/ alternately parallel and antiparallel to the [111] direction.

8610 Positron-lifetime study of irradiation effects in copper irradiated with energetic protons. Howell, R.H. (Lawrence Livermore Laboratory, Livermore, California 94550). *Phys. Rev., B;* **18**: No. 7, 3015-3025(1 Oct 1978).

Copper samples have been irradiated with protons in the energy range 4.5 to 25 MeV. The resulting damage effects in the copper have been studied with the positron-lifetime measurement. Evidence that the surviving defects are vacancylike is presented. The dependence of the defect production rate on proton energy and on irradiation temperature suggest that the defect production depends on more than one mechanism, one of which occurs only when the copper recoil energy is above a threshold of about 55 keV.

8611 Measurement of the pair potential in aligned Pb-Cd lamellar eutectic composites. Zaitlin, M.P. (Ames Laboratory-U.S. Department of Energy, Iowa State University, Ames, Iowa 50011). *Phys. Rev., B;* **18**: No. 7, 3298-3304(1 Oct 1978).

Thermal-conductivity measurements have been used to study the pair potential in multilayer superconductor—normal-metal lamellar composites. Lamellar Pb-Cd eutectic samples were prepared by a high-speed directional solidification technique which generates large single-grain samples with all the lamellae lined up in the same direction. For thin Cd layers where the pair potential Δ is expected to be uniform throughout the Cd, the pair potential is found to be $\sim$ 40% of the value in bulk Pb. This gives direct experimental evidence that the boundary condition requiring continuity of Δ/NV applies in the clean regime. Surprisingly, the electron mean free path in the Cd is longer than the width of the lamellae implying that Andreev scattering is suppressed at the Pb-Cd interface.

8612 Magnetic-flux entry into aligned Pb-Cd eutectic composites in the proximity-effect regime. Zaitlin, M.P. (Ames Laboratory—U. S. Department of Energy, Iowa State University, Ames, Iowa 50011). *Phys. Rev., B;* **18**: No. 7, 3305-3312(1 Oct 1978).

The thermal conductivity of Pb-Cd lamellar eutectic composites was measured as a function of the applied magnetic field from 1 to 8 K. The directions of heat flow and magnetic field were parallel to each other and to the lamellae. For samples of large periodicity, the data are consistent with the theory of Dobrosavljevic and de Gennes in which the magnetic flux enters the Cd lamellae in the form of quantized vortices. The resulting decrease in thermal conductivity is interpreted in terms of Andreev scattering of quasiparticles at the pair-potential barrier of a vortex. These results are compared with similar measurements by Deutscher et al. on vapor-deposited Pb-Ag-Pb films.

8613 ^{129}I magnetic hyperfine structure in the Heusler alloys Pd_2MnSb and PdMnSb. Boolchand, P.; Tenhover, M.; Jena, P. (Physics Department, University of Cincinnati, Cincinnati, Ohio 45221). *Phys. Rev., B;* **18**: No. 7, 3393-3399(1 Oct 1978).

Hyperfine fields at ^{129}I sites in the Heusler alloys Pd_2MnSb and PdMnSb have been measured and are shown to form part of a systematic trend of fields observed at 5sp elements. Theoretical estimates of these fields based on a homogeneous spin-polarized electron-gas model are compared to the observed field systematics.

8614 Dielectric phase transition in the superconducting compounds HfV_2 and ZrV_2(C15). Pan, V.M.; Bulakh, I.E.; Kasatkin, A.L.; Shevchenko, A.D. (Institute of Metal Physics, Ukrainian Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 11, 594-598(5 Jun 1978).

The anomalous behavior of the temperature dependences of the resistivity and magnetic susceptibility indicates that in the compounds HfV_2 and ZrV_2 a phase transition takes place with partial dielectrization of the electron spectrum. At temperatures below the transition temperature a nonlinear increase of the conductivity in an electric field is observed.

8615 Crystalline electric field levels of U in UPd_3 - an inelastic neutron scattering study. Shamir, N.; Melamud, M.; Weger, M. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev); Shaked, H. (Argonne National Lab., Ill. (USA)). *Physica, B, C;* **94**: No. 2, 225-227(May 1978).

Experimental evidence is presented of an unambiguous observation by neutron scattering of energy-localized excited crystalline electric-field states of an actinide ion in a metallic compound. Energy transfer lines were found in an inelastic neutron-scattering experiment using a UPd_3 powder sample. These lines exhibit the following features: (a) The energies of the lines are Q independent. (b) The Q dependence of the line intensities concurs with the magnetic form factor of U^{4+}. (c) The intensity of the line due to transitions from the ground state decreases as the temperature increases.

8616 Temperature- and photon-energy-induced breakdown of the direct transition model in Cu. Stoehr, J.; Williams, R.S.; Wehner, P.S.; Shirley, D.A. (Univ. of California, Berkeley). pp 240-243 of Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Inst. of Physics (1978).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

The first experimental demonstration that the photoemission cross section contains a Debye-Waller factor which favours phonon-assisted (or indirect) transitions for both high photon energies and high temperatures is presented.

8617 Fermi surface of concentrated paramagnetic Cu/sub c/Ni/sub 1-c/ alloys. Gordon, B. (Univ. of Bristol, Eng.); Temmerman, W.M.; Gyorffy, B.L.; Stocks, G.M. pp 402-405 of Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Inst. of Physics (1978).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

A number of Fermi-surface properties of concentrated Cu—Ni alloys have been calculated. The calculations are based on the CPA for a non-overlapping potential model of the crystal potential. Results are compared with empirically determined Fermi-surface parameters.

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 7565, 7567, 7568, 7849, 7910, 7927, 7929, 8034, 8036, 8073

8618 (ORNL—5431) **Effect of oxidizing environment on mechanical properties of molybdenum and TZM.** Liu, C.T.; Anderson, S.H.; Inouye, H. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 40p. Dep. NTIS, PC A03/MF A01.

The effect of environment on mechanical properties of molybdenum and TZM was investigated in low-pressure (1.3-mPa) oxygen at 1150°C. Specimens of TZM picked up oxygen and lost carbon. The oxygen concentration increases linearly with exposure time, indicating that the chemisorption of oxygen molecules at the specimen surface, rather than bulk diffusion, controls the kinetics of oxygen absorption at 1150°C. Specimens of TZM increase in tensile strength and decrease in ductility with increasing oxygen content. Exposed TZM loses its ductility at elevated temperatures at an oxygen level of 500 ppM. The embrittlement is due to the formation of zones or oxide precipitates, which harden the alloy and promote the brittle fracture associated with cleavage and grain-boundary separation. Unalloyed molybdenum responds to the oxidizing environment quite differently from TZM. The molybdenum (containing no active element such as Ti and Zr) showed no internal oxidation at 1150°C. Instead, our results indicate that a trace of oxygen penetrated into molybdenum through its grain boundaries. This penetration raises the ductile-to-brittle transition temperature of molybdenum by 200°C lowers the ductility above 900°C. The ductility of oxygen-exposed molybdenum is virtually unaffected in the temperature range from 400 to 900°C. A ductility minimum (10%) is observed at 1350°C because of dynamic embrittlement effects; that is, diffusion of oxygen to grain boundaries or crack tips where high triaxial states of stress are generated during plastic deformation. This embrittlement can be totally eliminated by an increase in strain rate.

8619 Corrosion failures of CuNi 30 Fe-tubes caused in cooling water by 'denickelation'. Buehler, H.E. (Thyssen A.G., Duisburg (Germany, F.R.). Abt. Forschung); Heller, H.J.; Herbsleb, G.; Pfeiffer, B. (Mannesmann-Forschungsinstitut G.m.b.H., Duisburg (Germany, F.R.)). *Z. Metallkd.;* **69**: No. 6, 418-423(Jun 1978). (In German).

In oil-coolers of an electric power station, tubes of the copper-nickel alloy CuNi 30 Fe were stressed by a relatively soft, low alkaline cooling water (maximum temperature 120°C, chloride concentration $<=$110 ppm). Corrosion failures and wall penetrations, caused by the lack of a protective layer, occurred after a two year service period. Investigation of the type of corrosion by means of light-microscopical methods resulted in contradictory findings. In corroded areas the presence of a pure copper phase, pluglike covering the alloy phase, was established. The formation of the copper phase may be explained as well by a topotactic reaction, i.e. denickelation of the alloy, as by an epitactic transformation, i.e. dissolution of the alloy and reprecipitation of copper by electro-crystallization. Estimation of the solid-state diffusion rate necessary for denickelation and further detailed electron-optical and electron-beam-microanalytical investigations gave clear evidence for a mechanism characterized by anodic dissolution of the solid-solution alloy as a whole followed by epitactic reprecipitation of the copper phase.

8620 Casting alloy. Hoekje, H.H. (to PPG Industries, Inc., Pittsburgh, Pa. (USA)). German(FRG) Patent 2,440,010/B/. 7 Jul 1977. 8p. (In German).

A cast alloy, consisting of 0.1-2.0% boron, 4-14.0% iron, silicon, and process-caused unipurities, is proposed as material for an

anode to be used in electrolytic cells with acid electrolyte. This material has a good electric conductivity, high corrosion-resistance, and a good capability of being cast. With a sufficient share of iron silicite a volumetric expansion coefficient of < 5% can be achieved, leading to extremely small internal and thermal stresses. A number of examples give information on structure, electric conductivity, and phase formation.

8621 Corrosion patterns in tube materials for PWR-steam generating plants in conditioned secondary water at 350°C-capsule-tests. Effertz, P.H.; Forchhammer, P. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning (Germany, F.R.)). *Maschinenschaden;* **50**: No. 5, 180-184(1977). (In German).

The authors investigate the intercrystalline stress crack corrosion behaviour of pipe capsules made of the steam generator materials Inconel 600 und Incoloy 800. The tests were carried out at 350°C and an internal pressure of 170 bar. Apart from this, wear rates have been determined in dependence of the pressurized water composition for up to 10.000 hours of operation. The comparative results show tendencies for corrosion protection by water chemistry measures.

RADIATION EFFECTS

REFER ALSO TO CITATION(S) 8071, 8137, 8139, 8140, 8141, 8153, 8154, 9210, 9365

8622 (CONF-780952—2) **Effects of irradiation on the copper normal metal of a composite superconductor.** Williams, J.M.; Klabunde, C.E.; Redman, J.K.; Coltman, R.R. Jr.; Chaplin, R.L. (Oak Ridge National Lab., TN (USA); Clemson Univ., SC (USA)). 1978. Contract W-7405-ENG-26. 15p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

This report presents a new body of magnetoresistance data for copper that were obtained in neutron irradiation experiments at 4K and 330K. These data are combined with previously obtained results on initial damage rates and saturation effects to yield a projection of total resistivity vs neutron dose (expressed in displacements per atom) for copper in service at < 10 K in a magnetic field.

8623 (NUREG/CP—0004(Vol.2), pp 549-561) **Radiation-induced defect production and annealing in strained and impure bcc metals.** Beeler, J.R. Jr.; Beeler, M.F. (North Carolina State Univ., Raleigh). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

This paper concerns computer experiment results on the effects of general and local strain fields during radiation-induced defect production and annealing in bcc iron and tungsten. Also, one example is given for nickel, an fcc metal. Computer experiment studies of this type were started very recently and, hence, the work that has been done mainly is exploratory. The results obtained thus far indicate that elucidation of strain field effects will induce a pervasive revision of current conceptual models for radiation-induced defect production and annealing. Seven topics are treated: (1) Vacancy production near a free surface; (2) Frenkel pair production near a preexistent self interstitial; (3) Dynamically induced vacancy movement; (4) Dynamically induced interstitial movement; (5) The effect of strain on the vacancy migration energy; (6) The effect of interstitial impurities on the displacement energy; and (7) The effect of thermal displacements on collision cascade development.

CERAMICS, CERMETS, AND REFRACTORIES

REFER ALSO TO CITATION(S) 8527

PREPARATION AND FABRICATION

REFER ALSO TO CITATION(S) 7472, 8200

STRUCTURE AND PHASE STUDIES

8624 Switching in V_3O_5 due to a phase transition. Bondarenko, V.M.; Alekseyunas, A.A.; Terukov, E.I. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad; Institute of the Physics of Semiconductors, Academy of Sciences of the Lithuanian SSR). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 148(Mar 1978).

The static I-V properties of V_3O_5 were studied as a function of temperature. Switching was observed at current levels higher than required due to the thermistor effect. (AIP)

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 8629

8625 Magnetic excitations in an amorphous ferromagnet. Tarvin, J.A. (Brookhaven National Lab., Upton, NY); Shirane, G.; Birgeneau, R.J.; Chen, H.S. pp 514-518 of Transition metals, 1977. Lee, M.J.G.; Perz, J.M.; Fawcett, E. (eds.). London; Inst. of Physics (1978).

From International conference on physics of transition metals; Toronto, Canada (15 Aug 1977).

Magnetic excitations in amorphous $(Fe_{85}Ni_{35})_{75}P_{16}B_6Al_3$ have been studied up to T/sub C/ (572 K) by neutron scattering. The long-wavelength (q < or = to 0.2 A^{-1}) magnetic properties are found to be very similar to those in crystalline ferromagnets.

8626 Dispersion of the Faraday effect in a thin EuO/sub 1hyphendelta/ film. Samokhvalov, A.A.; Viglin, N.A.; Gunichev, A.F.; Loshkareva, N.N. (Institute of the Physics of Metals, Academy of Sciences of the USSR, Sverdlovsk). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 103(Mar 1978).

EuO films of thickness 0.25-0.45 μ with anion vacancies were examined in the temperature range 20-77°K. The magnetooptical quality factor was determined.(AIP)

8627 Hydrogen adsorption on zirconium carbide and its rhenium alloys. Matskevich, T.L.; Krachino, T.V. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 314-318(Mar 1978).

In contrast with nickel carbide, the amount of hydrogen adsorbed on zirconium carbide at 300 °K is the same as for polycrystalline transition metals. The initial hydrogen sticking factor, S_0, is 0.03 +- 0.02; the desorption temperature is 750—1000 °K, being approximately equal to that for the transition metals which form hydrides. The dissolution rate of hydrogen in zirconium carbide at 300 °K is about 1/50 the initial adsorption rate. The evolution of the dissolved hydrogen in zirconium carbide at 759—1500 °K occurs much more slowly than thermal desorption. A flash temperature of 2200—2500 °K is required in order to determine the total amount of absorbed hydrogen. The initial sticking factor of hydrogen on carbides is lower than that on the corresponding metals. The adsorption and thermionic-emission properties of the two-phase alloys ZrC—Re 21.7 at.% and ZrC—Re 84 at.% are approximately the same as those for ZrC. There are differences: The temperatures for hydrogen desorption from the solid solution ZrC(Re) and the solid solution Re(Zr, C) differ by 100—150 °K, and the factor S_0 for ZrC—Re 21.7 at.% depends on the "past history" of the sample. After exposure to the residual gases and to hydrogen the value of S_0 increases by a factor of 10^3 for ZrC—Re 21.7 at.%; heating restores the original value of S_0.

8628 Effect of oxidation of carbon on the work function of tantalum carbide. Chaikovskii, E.F.; Sotnikov, V.T.; Vlasenko, V.A. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 360-361(Mar 1978).

The thermionic work function of TaC is studied as a function of temperature in the range 1250—2000 °K while the surface is monitored by Auger spectroscopy. (AIP)

CORROSION AND EROSION

REFER ALSO TO CITATION(S) 8773

CORROSION, EROSION, AND DEGRADATION

REFER ALSO TO CITATION(S) 7902

POLYMERS AND PLASTICS

MECHANICAL PROPERTIES

REFER ALSO TO CITATION(S) 7737

PHYSICAL PROPERTIES

REFER ALSO TO CITATION(S) 7737, 7949

8629 (SAND—78-1125C) **Surface flashover model based on electron-stimulated desorption.** Anderson, R.A.; Brainard, J.P. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 16p. (CONF-780925—4). Dep. NTIS, PC A02/MF A01.

From 8. symposium on discharges and electrical insulation in vacuum; Albuquerque, NM, USA (5 Sep 1978).

A simple model is proposed to explain how a prebreakdown avalanche of secondary emission electrons can lead to surface flashover when an insulator in vacuum breaks down a few nanoseconds after the voltage is applied. The case of a plane insulator—vacuum

interface perpendicular to parallel electrodes is considered. Positive surface charging is assumed to occur almost immediately upon application of the high voltage, and the attendant secondary emission avalanche is assumed to operate at saturation throughout the major portion of the prebreakdown time delay. Bombardment of the insulator by avalanche electrons desorbs a cloud of gas, which is partially ionized as it drifts through the swarm of electrons in the avalanche. The field at the cathode end of the insulator becomes enhanced as positive ions accumulate, which enhancement in turn increases the rate of gas desorption and ionization. This and other regenerative processes rapidly lead to breakdown. The model predicts time delays and their dependence on voltage and insulator length which are in reasonable agreement with experimental observations. 4 figures.

OTHER MATERIALS

PREPARATION AND MANUFACTURE

REFER ALSO TO CITATION(S) 7670, 7671, 7672, 7674, 7675, 7680, 7682

8630 Some properties of evaporated amorphous silicon made with atomic hydrogen. Miller, D.L. ; Lutz, H.; Wiesmann, H.; Rock, E.; Ghosh, A.K.; Ramamoorthy, S.; Strongin, M. (Brookhaven National Laboratory, Upton, New York 11973). *J. Appl. Phys.;* **49**: No. 12, 6192-6193(Dec 1978).

We describe measurements on a-Si films made by adding atomic hydrogen during evaporation of silicon. The material has conductivity comparable to that formed by silane decomposition and is also photoconducting. The photocurrent in these initial experiments is smaller than in the bes silane-produced films.

STRUCTURE AND PHASE STUDIES

REFER ALSO TO CITATION(S) 7680, 7682

8631 Viscosity and thermal expansion of lithium aluminosilicate glasses. Shelby, J.E. (Sandia Laboratories, Livermore, California 94550). *J. Appl. Phys.;* **49**: No. 12, 5885-5891(Dec 1978).

Viscosity and thermal expansion have been measured for 12 series of lithium aluminosilicate glasses. The compositional dependency of the viscosity, glass-transformation temperature, dilatometric-softening temperature, and refractive index all exhibit an abrupt change in slope at an aluminum-to-lithium ratio between 1.05 and 1.10. The thermal-expansion coefficients of these glasses were found to depend only on the lithium oxide content, i.e., to be independent of the aluminum-to-silicon ratio. These results suggest that the traditional structural model for these glasses must be modified slightly. A new model is proposed which allows some aluminum to act as a modifier in all alkali aluminosilicate glasses.

8632 Lattice dynamics of hcp ^{4}He at high pressure. Eckert, J.; Thomlinson, W.; Shirane, G. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev., B;* **18**: No. 7, 3074-3081(1 Oct 1978).

The neutron-inelastic-scattering technique was used to measure the phonon dispersion relations in two high-density crystals of hcp ^{4}He with molar volumes of 11.61 and 9.41 cm^3/mol. These densities are on the order of twice that of ^{4}He at 30 bars. The crystals were grown from the melt in the fcc phase, and cooled across the fcc-hcp phase transition. The observed phonon spectra show anharmonic effects much less prominent than those observed in earlier measurements at 21 cm^3/mol. In particular, multiphonon interference effects were not found to be very pronounced, while multiphonon scattering appeared to influence phonon line shapes strongly for large wave-vector and energy transfers. Elastic constants determined from the initial slopes of the dispersion curves were found to be in good agreement with those calculated by Goldman using the first-order self-consistent-phonon theory. The dependence on volume of the phonon energies is discussed with reference to the earlier studies at 21.1 and 16.0 cm^3/mol. No significant dispersion of mode Grueneisen parameters was found unlike the case of fcc He. Grueneisen parameters were found to depend on volume approximately in a manner given by Ahlers for the thermodynamic Grueneisen parameter.

8633 Elastic neutron scattering of the "phase ordering" phase transition in Hg/sub 3-delta/AsF$_6$. Pouget, J.P.; Shirane, G.; Hastings, J.M.; Heeger, A.J.; Miro, N.D.; MacDiarmid, A.G. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev., B;* **18**: No. 7, 3645-3656(1 Oct 1978).

Elastic-neutron-scattering experiments performed on the linear-chain mercury compound Hg/sub 3-delta/AsF$_6$ are presented. On cooling, a progressive phase ordering between the Hg chains, randomly phased at room temperature, has been found and characterized. Short-range order gradually builds up, with transverse coherence lengths of a few lattice constants, as a result of parallel chain-chain interactions. At 120 K, the competing orthogonal chain-chain interaction leads to three-dimensional order and a phase-ordering phase transition. The three-dimensional low-temperature phase is accompanied by an incommensurate modulation of the Hg chains indicating an interaction with the host lattice.

8634 Pressure studies of rare earth singlet ground state systems. Schirber, J.E.; Weaver, H.T. (Sandia Labs., Albuquerque, NM). pp 503-505 of Valence instabilities and related narrow-band phenomena (1977). Parks, R.D. (ed.). New York; Plenum Publishing Corp. (1977).

Studies of the pressure dependence of the rare earth NMR in PrAs, PrP, and TmP have shown that the point-charge model gives the wrong sign for the volume dependence of the crystal field splitting in these materials. Similar conclusions were reached from pressure studies of the susceptibilities of closely related singlet ground state materials by Guertin et al. In a recent paper in which pressure derivatives were obtained as a function of temperature in order to vary the contributions of crystal field and exchange effects, it was shown that this unexpected volume dependence could not be attributed to exchange. These effects are believed to have their origin in pressure-induced changes in conduction electron character. As a test for this hypothesis, studies were begun on the isomorphous cogener PrN which is, however, an insulator. The point-charge model should be qualitatively correct for this material. No shift was detected in the Pr Knight shift (which is +290 percent) with 4 kbar at 4 K in PrN. It will be necessary to measure the compressibility of PrN before the significance of this result can be assessed.

PROPERTIES

REFER ALSO TO CITATION(S) 7348, 7682, 7737, 8033

8635 (BNL—24131) **Relationship between the short-time specific heat and the ultrasonic properties of glasses.** Black, J.L. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 7p. (CONF-780824—14). Dep. NTIS, PC A02/MF A01.

From 15. conference on low temperature physics; Grenoble, France (23 Aug 1978).

Theoretical predictions are made for heat-pulse experiments in glasses at temperatures below 1K. These calculations are based upon the tunneling model, using parameters determined from ultrasonic attenuation and phonon-echo experiments in vitreous silica. The theoretical results are compared with the heat-pulse experiments of Goubau and Tait. The theoretical value of the short-time specific heat is found to be roughly an order of magnitude smaller than the experimental value. This important discrepancy is discussed in terms of the underlying assumptions of the tunneling model.

8636 (LA—7448-PR) **Low Temperature Physics and Engineering quarterly progress report, April 1—June 30, 1978.** Keller, W.E. (comp.). (Los Alamos Scientific Lab., NM (USA)). Sep 1978. Contract W-7505-ENG-36. 52p. Dep. NTIS, PC A04/MF A01.

This report summarizes the significant progress achieved in several programs carried out in the Los Alamos Scientific Laboratory's Low Temperature Physics and Cryogenic Engineering Group (Q-10) during the period April 1 to June 30, 1978. Progress is documented for the following areas: analysis of environmental safety and safety controls for hydrogen; equation of state of solid and fluid hydrogen and deuterium; magnetic studies of solids at low temperature; experiments dealing with the destruction of superconductivity by current; electrical engineering, cryogenic engineering, and cable development leading to a prototype demonstration of a direct current superconducting power transmission line; development of conductors, electrical control apparatus, large Dewar vessels, and magnet coils for superconducting magnetic energy storage devices, as well as designs of these units for power system stabilization; design, testing, and procurement of equipment for separating and handling large amounts of tritium—deuterium mixtures for systems to be used in conjunction with Tokamak fusion reactors; experiments related to target preparation for the laser fusion programs; development of practical conductor of Nb_3Ge; and experiments leading to designs for magnetic refrigerators to be used for superconducting device applications in the electric power industry. 13 figures, 3 tables.

8637 Aggregation of defects and thermal-electric breakdown in MgO. Narayan, J.; Weeks, R.A.; Sonder, E. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *J. Appl. Phys.;* **49**: No. 12, 5977-5981(Dec 1978).

Transmission electron microscopy has been used to study defects in as-grown MgO single crystals and in crystals which had undergone high-temperature electrical conduction for long periods of time. Besides dislocation loops of (a/2<110>) Burgers vectors

and precipitates, a new type of defect, dislocation loops of $\alpha<100>$ Burgers vectors lying in {100} planes, has been observed in electric-field-treated specimens. The nature of both (a/2) <110> and $a<100>$ loops was determined to be vacancy type. The relation of this microstructure to the observed increase in electrical conductivity, which ultimately results in thermal-electric breakdown of the samples, is discussed.

8638 Raman spectroscopy of molecular hydrogen and deuterium dissolved in vitreous silica. Hartwig, C.M.; Vitko, J. Jr. (Sandia Laboratories, Livermore, California 94550). *Phys. Rev., B;* **18**: No. 7, 3006-3014(1 Oct 1978).

Earlier Raman studies confirming the molecular dissolution of protium and deuterium in silica have been extended to include room-temperature measurements of the vibrational-rotational Raman bands and the temperature dependence (11—800 K) of the Q bands. Observation of the S bands provides evidence for H_2 and D_2 molecular rotation in vitreous silica. The temperature and isotope dependence of the Q-band frequency shifts are found to agree with predictions of a solubility model based on a single molecule in a small confining interstice. The origin and temperature dependence of the Q-band line shape are discussed within the context of various models which include inhomogeneous broadening, collisional broadening, and recent theories of motional narrowing.

8639 Neutron study of the line-shape and field dependence of magnetic excitations in $CuCl_2$ x $2N(C_5D_5)$. Heilmann, I.U.; Shirane, G.; Endoh, Y.; Birgeneau, R.J.; Holt, S.L. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev., B;* **18**: No. 7, 3530-3536(1 Oct 1978).

We have carried out inelastic neutron scattering on $CuCl_2$ x $2N(C_5D_5)$, at T = 1.2 K and at magnetic fields up to 70 kOe. The spin dynamics of this typical s = 1/2 one-dimensional Heisenberg antiferromagnet have previously been investigated at zero magnetic field by Endoh et al., using neutron scattering. They observed a spectrum of magnetic excitations in close agreement with the spectrum of lowest excited states as calculated exactly by des Cloizeaux and Pearson (dCP). The marked asymmetry in the line shape of the neutron response previously observed is carefully reexamined and is shown to be a true effect, in agreement with several theoretical predictions. At high magnetic field, a broadening of the neutron response is observed, especially pronounced at the antiferromagnetic zone boundary, where the peak smears out at 70 kOe. For wave vectors near an antiferromagnetic Bragg point a decrease in the peak energy is observed for increasing field, lending qualitative support to the calculations of Ishimura and Shiba of the field dependence of the dCP states.

8640 Conduction-electron polarization in intermetallic actinide compounds. Jena, P.; Emmons, R.; Lam, D.J.; Ray, D.K. (Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev., B;* **18**: No. 7, 3562-3567(1 Oct 1978).

The large conduction electron polarization observed in many intermetallic actinide compounds with well localized 5f moments is analyzed using a phenomenological model for the electron density of states. The model is applied to PuP and successfully predicts appreciable polarization effects existing in the paramagnetic phase. Possible consequences of this model in our understanding of the electronic structure of other actinide compounds with the NaCl-type structure are discussed.

8641 Pressure dependence of magnetic excitations in SmS. McWhan, D.B.; Shapiro, S.M.; Eckert, J.; Mook, H.A.; Birgeneau, R.J. (Bell Laboratories, Murray Hill, New Jersey 07974). *Phys. Rev., B;* **18**: No. 7, 3623-3630(1 Oct 1978).

Inelastic-neutron-scattering studies using triple-axis and time-of-flight techniques have been made in the low- and high-pressure phases of a polycrystalline sample of ^{154}SmS. There is no observable change in the energy or width of the $^7F_0$-$^7F_1$ excitation of the $4f^6$ configuration between ambient pressure and 0.6 GPa. In the mixed-valence phase at high pressure, there is no evidence for well-localized excitations from either the $^7F_0$-$^7F_1$ ($4f^6$) or the $\Gamma_7\Gamma_8$ (^6H/sub 5/2/, $4f^5$) configurations. These results suggest that the mixed-valence phase is homogeneous. Lattice-parameter measurements versus pressure at 85 and 298 K show no evidence for pretransitional softening and establish that the phase diagram in the P-T plane is reentrant. From the phase diagram and earlier heat-capacity measurements, the electronic entropy in the mixed-valence phase is estimated to saturate at $\simeq$ 2R with increasing temperature.

CORROSION, EROSION, AND DEGRADATION

REFER ALSO TO CITATION(S) 7260, 7737

CHEMISTRY

8642 Abstracts of papers. 174th American Chemical Society meeting. Washington, DC; American Chemical Society (1977). 800p. (CONF-770814—(Absts.)). The Publisher, Room 803, 1155 16th Street, NW, Washington, DC.

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Abstracts of most of the papers presented at the 174th American Chemical Society Meeting are included in this volume.

ANALYTICAL AND SEPARATIONS CHEMISTRY

8643 (UCRL—52000-78-8) **Energy and technology review.** Shay, H.D.; Crawford, R.B.; Prono, J.K.; Staehle, J.T. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1978. Contract W-7405-ENG-48. 34p. Dep. NTIS, PC A03/MF A01.

Separate abstracts were prepared for four of the included sections. (MOW)

ACTIVATION AND NUCLEAR REACTION PROCEDURES

REFER ALSO TO CITATION(S) 8644

RADIOMETRIC AND RADIOCHEMICAL PROCEDURES

REFER ALSO TO CITATION(S) 7515

8644 Proceedings of the third international conference on ion beam analysis. Wolicki, E.A.; Butler, J.W.; Treado, P.A. (eds.). New York; North Holland Publishing Company (1978). 768p. (CONF-770642—).

From 3. international conference on ion beam analysis; Washington, DC, USA (27 Jun 1977).

A total of 132 papers are included, arranged under the following headings: light element profiling, energy loss and straggling, scattering analyses, analysis by nuclear reactions, surface and defect studies by channeling, analysis by ion-induced x-rays, ion-induced optical emission and SIMS, low-energy backscattering and ISS, combined techniques, and appratus and target standards. Separate abstracts were prepared for 13 papers. (DLC)

SPECTRAL PROCEDURES

REFER ALSO TO CITATION(S) 7234, 7484, 7521

8645 Contributions to automated trace analysis. Pt. 3. A sensitive automated method for the determination of mercury in biological and environmental samples. Matthes, W.; Flucht, R.; Shoeppler, M. *Z. Anal. Chem.;* **291**: No. 1, 20-26(Jun 1978). (In German).

A modified automated cold vapour AAS procedure using an AutoAnalyzerII system is described. The procedure permits the determination of inorganic as well as total mercury and enables one to perform up to 120 analyses/day. The enrichment of mercury as amalgam on silver wool, followed by a fast thermal decomposition with the aid of a graphite cuvette, enables a detection limit of 0.01 ng/ml sample solution. The relative standard deviation for homogeneous samples and the overall procedure is <= 15%. During the analysis of certified standard reference materials no systematic deviations were observed. The average total (2sigma) error for a single sample should therefore not exceed 30%.

SEPARATION PROCEDURES

REFER ALSO TO CITATION(S) 7300

8646 (SRO—854-21) **Effects of operating variables on peak shape in gel permeation chromatography.** Glajch, J.L.; Warren, D.C.; Kaiser, M.A.; Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). Sep 1978. Contract EY-76-S-09-0854. 26p. Dep. NTIS, PC A02/MF A01.

The effects of flow rate, solute molecular weight, added dead volume, and different detectors on peak shape in a gel permeation chromatographic (GPC) system have been studied. Toluene and three monodispersed polystyrenes, having nominal molecular weights of 37,000, 110,000, and 233,000 were examined using the second moment, the standard deviation of the Gaussian component of the peak (sigma), and the exponential tailing function. Detector effects reflected primarily the cell volume and not the additional dead volume that included its connecting tubing. The addition of 25-μL of narrow-bore tubing between the injector and the column slightly decreased the second moment of the peak. The use of sigma

values, in addition to the second moment, also allowed confirmation of previous predictions based on computer simulation studies showing peak spreading as a function of molecular weight.

8647 (SRO—854-22) **Fundamental studies of separation processes. Technical progress report.** Rogers, L.B. (Georgia Univ., Athens (USA). Dept. of Chemistry). Sep 1978. Contract EY-76-S-09-0854. 16p. Dep. NTIS, PC A02/MF A01.

During the past year, studies have been initiated in the following areas: information content as a means of describing chromatographic separations, effects of operating pressure and particle size on the efficiency of recycle gas chromatography, comparison of new liquid chromatographic column packings (and solvent combinations) for difficult fractionations as represented by oligomeric polystyrenes, fractionations of the isotopic species of carbon monoxide, and complex mixtures of vanadium porphyrin complexes found in Venezuelan crude oils. In addition, a study of the fractionation of oligomers of polystyrene using supercritical fluid chromatography was completed and another on the effects of multiple (in series) liquid chromatographic detectors on chromatographic peak shapes is nearing completion. Finally, the effects of flow rate and dead volume on peak shapes obtained in steric-exclusion chromatography have been examined using two different methods for data analysis.

8648 **Effect of radiolysis products of di-(2-ethylhexyl)phosphoric acid upon the extraction of lanthanides.** Tachimori, S.; Krooss, B.; Nakamura, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *J. Radioanal. Chem.;* **43**: No. 1, 53-63(1978).

In the processing of high-level liquid wastes, an extractant receives a maximum radiation of about 200 W.h/dm^3 during extraction. In order to clarify the influence of radiation degradation of DEHPA upon the extraction of lanthanides, the extraction of neodymium(III) was studied using DEHPA, MEHPA, 2-ethylhexanol and γ-ray irradiated DEHPA. 20 cm^3 portions of the extractant solution and an aqueous Nd(III) solution spiked with ^{147}Nd tracer were placed in separatory funnels and shaken for about 3 min. The aqueous and organic phases were separated by centrifugation. The distribution ratio (Df) - based on the measurement of the gamma activity - defined as the concentration of Nd(III) in the organic phase divided by the concentration of the element in the aqueous phase was determined as a function of the composition of the organic and aqueous solutions. The most significant effect of DEHPA radiolysis on the extraction was found to be the enhancement of extraction capability mainly due to the primary radiolysis product MEHPA. 2-ethyl-hexanol, another radiolysis product, showed a depressant effect on DEHPA-Nd(III) extraction. However, the mixture of MEHPA and 2-ethylhexanol improved the extraction. The mixed solvent DEHPA-MEHPA was found to be more effective than the individual components for lanthanide extraction.

INORGANIC AND PHYSICAL CHEMISTRY

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

8649 (CONF-780743—1) **Luminescence of U^{3+} in $LaBr_3$.** Hessler, J.P.; Hegarty, J.; Levey, C.G.; Imbusch, G.F.; Yen, W.M. (Argonne National Lab., IL (USA)). 1978. Contract W-31-109-ENG-38. 10p. Dep. NTIS, PC A02/MF A01.

From Conference of luminescence; Paris, France (Jul 1978).

The luminescence behavior of the M-level of U^{3+} in $LaBr_3$ (18388 cm^{-1}) has been studied with time resolved tunable dye laser techniques. Multiple sites have been detected. A unique site is identified; its inhomogeneous width and the temperature dependence of the fluorescence lifetime have been measured.

8650 (COO—2807-14) **Experimental investigation of the chemistry of excited states of rare gases. Third quarterly progress report, April 15, 1978—July 15, 1978.** Setser, D.W. (Kansas Univ., Lawrence (USA). Dept. of Geology). Jul 1978. Contract EY-76-S-02-2807. 10p. Dep. NTIS, PC A02/MF A01.

The quenching of XeF(B) was studied by using the steady-state photolysis of XeF_2 as the source of XeF(B). The XeF(C) state was observed, as well as the XeF(B) state, by using a very clean CO(A-X) resonance lamp to photolyze the XeF_2. XeF(C) must be included in the kinetic scheme in order to understand the quenching of XeF*. The preliminary work that has been done with the Xe($^3P_1$) and Kr($^3P_1$) resonance atom reactions is summarized. The pulsed laser induced fluorescence technique was used to measure radiative lifetimes and two-body quenching rate constants. The study of Ne(3p)** in Ne Buffer has been completed and tables of these results are included. Some exploratory work searching for new emission spectra and with an emphasis on rare gas oxide spectra has been done and is described.

8651 **Kinetics of transport of CO_2 through porous CaO and BaO formed by carbonate decomposition.** Roberts, J.A. Jr.; Jacobson, N.S.; Searcy, A.W. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720). *J. Chem. Phys.;* **69**: No. 12, 5562-5563(15 Dec 1978).

The decomposition of single crystals of $CaCO_3$ and $BaCO_3$ has been studied. The transport of CO_2 through porous solids is studied by knudsen flow. (AIP)

8652 **Stochastic theory of bimolecular, heterogeneous, surface catalytic reactions.** Landman, U.; Shlesinger, M.F. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). *Phys. Rev. Lett.;* **41**: No. 17, 1174-1178(23 Oct 1978).

A stochastic theory of heterogeneous bimolecular reactions catalyzed by active sites is formulated using a defect-renormalized propagator method. Reaction between adsorbed migrating species occurs upon their coincidence on active sites, and may demand proper internal-state configurations. Effects due to spatial heterogeneity, lattice structure, and internal states on the reaction evolution are analyzed.

8653 **Infrared spectra of some nonreduced methanation catalysts.** Bradley, E.B.; Stencel, J.M. (Department of Electrical Engineering and Institute of Mining and Minerals Research, University of Kentucky, Lexington, Kentucky 40506). *Appl. Spectrosc.;* **32**: No. 5, 496-499(Sep 1978).

The infrared spectra (4000 to 400 cm^{-1}) of two commercial nonreduced methanation catalysts have been recorded and interpreted. The catalyst are prepared as mixtures of (a) nickel in a silica support and (b) nickel in an alumina support. Graphite is added to these mixtures as a binder to facilitate pressing of catalyst pellets for commercial use. It is revealed in the spectra of the catalysts that although (a) is prepared to have a simple NiO/Sio$_2$ composition the silica support is not of the form SiO_2; rather the spectral characteristics are similar to those found for linear chain silicates. In (b) the Al-O vibrations are characteristic of amorphous Al_2O_3, and H_2O is tightly bound in the pellet. The CO_3/sup ion is present in both (a) and (b). It is not bound to Ni in either (a) or (b), but it is bound in the silicate structure of (a) and associated with Al in (b). The presence of the ion cannot be explained by only n situ generation from atmospheric CO_2 and H_2O, but its presence must be due to residual CO_3/sup from the catalyst preparation.

8654 **Thermodynamics of electrolytes. X. Enthalpy and the effect of temperature on the activity coefficients.** Silvester, L.F.; Pitzer, K.S. (Univ. of California, Berkeley). *J. Solution Chem.;* **7**: No. 5, 327-337(May 1978).

Heat of dilution and of solution data are fitted to the form of equation corresponding to that used successfully for activity and osmotic coefficients over a wide range of concentrations. The resulting parameters give the change with temperature of the activity and osmotic coefficients. Results are reported for 84 electrolytes of 1-1, 2-1, 3-1, and 2-2 valence types.

8655 **Thermoanalytical investigations of thallous nitrate.** Clark, R.P.; Reinhardt, F.W. (Sandia Labs., Albuquerque, NM). *J. Therm. Anal.;* **13**: No. 2, 321-326(Apr 1978).

Thallous nitrate was investigated using thermogravimetry (TG), defferential thermal analysis (DTA), and differential scanning calorimetry (DSC) in conjunction with gas chromatography and X-ray diffraction analysis. TG showed a weight loss beginning at approximately 380° with a 50% loss by 520°. This weight loss was demonstrated to be caused by boiling rather than thermal decomposition. The DTA extrapolated onset temperature for the boiling was 467°. Two solid-solid transition points and the melting point were determined by DTA to be 77, 145, and 207°, respectively. Heat of transition values determined by DSC were 0.15 kcal/mole at 77°, 0.87 kcal/mole at 145°, and 2.18 kcal/mole for the melting at 207°.

8656 **Enhancement factors for gas-absorption with second-order irreversible chemical reaction.** Wellek, R.M.; Brunson, R.J.; Law, F.H. (Univ. of Missouri, Rolla). *Can. J. Chem. Eng.;* **56**: No. 2, 181-186(Apr 1978).

A relatively simple, explicit mathematical expression has been developed for estimating the enhancement factors for mass transfer accompanied by a second-order irreversible chemical reaction. The development is based on asymptotic characteristics, i.e., limiting solutions, for second-order enhancement factors. The resulting mathematical relation and other approximate analytical formulations previously presented in the literature have been critically compared with a numerical solution for the diffusion-reaction process based on film theory.

8657 **Phase analysis of sulfur compounds in solid absorbents.** Kusenko, G.K.; Avgushevich, I.V.; Kulikova, E.S. (Inst. of Mineral Fuels, Moscow). *Khim. Tverd. Topl.;* No. 2, 23-28(1977). (In Russian).

A method for the chemical phase analysis of sulfur compounds is proposed for controlling the composition of limestone-derived solid absorbants for sulfur oxides.

ORGANIC CHEMISTRY

CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

8658 Intersystem crossing in molecular dimers. Bowman, M.K.; Norris, J.R. (Argonne National Lab., IL). *Chem. Phys. Lett.;* **54**: No. 1, 45-48(15 Feb 1978).

Intersystem crossing in molecular pairs is examined in relation to the structure of the pair. Simple relationships are derived which differ from previously reported ones by the inclusion of the vibronic nature of intersystem crossing.

8659 Graph theoretical analysis of diamagnetic susceptibilities of alkanes and alkenes. Randic, M. (Iowa State Univ., Ames). *Chem. Phys. Lett.;* **53**: No. 3, 602-605(1 Feb 1978).

An alternative description of the additivity of diamagnetic susceptibilities of alkanes established by Hameka is given. The analysis is based on an examination of molecular graphs and enumeration of selected graph theoretical invariants (subgraphs). The generality of the approach is illustrated by extending the analysis to alkenes. 2 tables.

8660 Dihedral-angle dependence of geminal, scalar coupling-constants in [1-^{13}C]-amino sugars. Walker, T.E.; London, R.E.; Barker, R.; Matwiyoff, N.A. (Los Alamos Scientific Lab., NM). *Carbohydr. Res.;* **60**: 9-18(1978).

2-Amino-2-deoxy-D-[1-^{13}C]-glucose and -mannose hydrochlorides have been studied by ^{13}C and ^{1}H n.m.r. spectroscopy. The carbon—carbon and carbon—hydrogen coupling-patterns observed are qualitatively similar to results obtained with the [1-^{13}C]hexoses. In both of the amino sugars studied, resolvable C-1—C-3 coupling was observed only for the β anomers, whereas C-1—C-5 coupling was observed only for the α anomers. In addition, the C-1—H-2 couplings exhibit the same dihedral-angle dependence found for other [1-^{13}C]hexoses. Specific, homonuclear decoupling of H-1 indicates that the C-1—H-2 coupling constants are negative for the α and β anomers of both amino sugars. The dihedral-angle dependence of the geminal C-1—H-2 coupling is thus qualitatively invariant to the presence of the amino group and appears to be a useful conformational probe.

ELECTROCHEMISTRY

8661 Application of solid state electrolytes - a survey. Baukal, W.; Knoedler, R.; Kuhn, W. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). *Chem.-Ing.-Tech.;* **50**: No. 4, 245-249(Apr 1978). (In German).

From Lecture meeting of the GDCh-Fachgruppe Angewandte Elektrochemie on electrolytes - aqueous, organic, fused-mass, solid electrolytes, ion exchanger membranes; Darmstadt, Germany, F.R. (6 - 7 Oct 1977).

Ionic conduction in solids has numerous potential applications in the fields of instrumentation, energy storage, energy conversion, and production of chemicals. The present state of development of the various processes and devices ranges from industrial maturity via application tests and R and D work to projects in the concept stage. The state of the art is briefly reviewed.

PHOTOCHEMISTRY

REFER ALSO TO CITATION(S) 8663

8662 (COO—3416-8) **Photochemistry and radiation chemistry of volatile silanes and germanes. Progress report, September 1, 1977—August 31, 1978.** Lampe, F.W. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1978. Contract EY-76-S-02-3416. 14p. Dep. NTIS, PC A02/MF A01.

Status of the following studies is reported: the 147 nm photolysis of hexafluoroacetone; the 147 nm photolysis of nonosilane; construction of new tandem mass spectrometer; reactions of methyl cations with methylsilanes; and formation of GeH^+_s and the proton affinity of GeH_4. (LK)

RADIATION CHEMISTRY

REFER ALSO TO CITATION(S) 7433, 7486, 7505, 8648, 8662, 8917

8663 (COO—3221-5) **Nature of oxygen containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, September 1977—July 1978.** Czapski, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1978. Contract EX-76-C-02-3221. 40p. Dep. NTIS, PC A03/MF A01.

The main emphasis will be given to further study the properties of HO_2 and O^-_2 and OH, mainly in their role in biological systems. We will continue to study and elucidate how O^-_2 reacts in biological systems. The toxicity of O^-_2 is quite well established, but the mechanism is still obscure. The Haber Weiss reaction most probably cannot account for the toxicity of O^-_2 nor for the formation of singlet oxygen, nor of OH. We will study if reduction of Fe^{3+} complexes by O^-_2 in biological systems does catalyze the Haber Weiss raction and if OH is formed in this mechanism. The role of oxygen, radiosensitizers in radiation damage of bacteriophages and cells will be further studied. We will try to elucidate the formation and role of OH, O^-_2 and O_2 in these systems as well as the relative contribution of endogenous and exogenous damage, and the role of direct and indirect radiation damage to cells.

8664 Radiation-chemical studies of the reaction of SO_4^- with uracil and its derivatives. Bansal, K.M.; Fessenden, R.W. (Carnegie-Mellon Univ,. Pittsburgh). *Radiat. Res.;* **75**: No. 3, 497-507(Sep 1978).

Several radiation-chemical methods have been used to study the reaction of SO_4^- with uracil, isoorotic acid, and thymine. Pulse radiolysis with spectrophotometric detection has shown that the products in neutral solution absorb well beyond 500 nm and in each case are different from those produced by OH reaction. The spectrum of the radical from uracil has peaks at 410 and 560 nm with calculated extinction coefficients of 1000 and 750 M^{-1} cm^{-1} respectively. The spectrum obtained with thymine is similar while that obtained with isoorotic acid shows a single peak at 470 nm with an extinction coefficient of 2200 M^{-1} cm^{-1}. Conductometric experiments show that release of a proton accompanies radical formation. The ESR spectra obtained in steady-state radiolysis experiments with uracil and isoorotic acid are characterized by g factors of about 2.0044. These radicals represent the acidic forms of radicals previously observed to be formed by OH in basic solution. The ESR parameters match those found in single crystal experiments for radicals believed to be formed by the net loss of a hydrogen atom from N1. Possible reaction mechanisms are discussed. The reaction of Cl_2^- with uracil gave the same product as did SO_4^-. Conductometric experiments were also carried out which show that the electron adduct to uracil reacts with $S_2O_8^{2-}$ with $k = 2.2 \times 10^8$ M^{-1} sec^{-1}.

8665 Radiation chemistry of aqueous solutions of cyanamide. Draganic, Z.D.; Draganic, I.G.; Jovanovic, S.V. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). *Radiat. Res.;* **75**: No. 3, 508-518(Sep 1978).

Oxygen-free aqueous solutions of 0.1 M NH_2CN (pH 2.4 and 5) were irradiated with γ rays (0.01—25 Mrad). The rate constants determined in competition experiments are: $k(H + NH_2CN) = 6.7 \times 10^6$ M^{-1} sec^{-1}, $k(e/sub\ aq/^- + NH_2CN) = 1.5 \times 10^9$ M^{-1} sec^{-1}, and $k(OH + NH_2CN) = 8.5 \times 10^6$ M^{-1} sec^{-1}. Radiation-chemical yields were determined for the decomposition of cyanamide molecules and the formation of several radiolytic products. The following compounds were identified in irradiated solutions: H_2, CO_2, NH_3, urea, biuret, arginine, and a—N=N— molecule assigned to methylaminoazoformamide. Possible reactions of secondary free radicals leading to the formation of radiolytic products were considered by taking into account the model of water radiolysis and the measured radiation yields.

8666 High-LET pulse radiolysis: O_2^- and oxygen production in tracks. Sauer, M.C. Jr.; Schmidt, K.H.; Jonah, C.D.; Naleway, C.A.; Hart, E.J. (Argonne National Lab., IL). *Radiat. Res.;* **75**: No. 3, 519-528(Sep 1978).

The production of O_2^- in the radiolysis of water at pH 7 and 11 has been investigated using pulses of 20-MeV deuterons and 40-MeV alpha particles. The G-values of O_2^- are estimated by comparing the observed optical absorptions at ca. 252 nm with the absorptions calculated on the basis of known reaction rate constants and absorption coefficients of species produced in water radiolysis. The experimental observations can be explained reasonably well without invoking primary yields of O_2^- or O_2, although there is room, within the limits of error, for a contribution from such primary yields. The observations are discussed in relation to the "oxygen in the track" hypothesis, and arguments are presented showing that species formed in the track (e.g., O_2, O_2^-) with small G-values do not allow an explanation of the known effects of radiation quality on the relative biological effectiveness and the oxygen enhancement ratio in terms of this hypothesis.

PROPERTIES OF RADIOACTIVE MATERIALS

REFER ALSO TO CITATION(S) 7491, 8649

COMBUSTION CHEMISTRY

REFER ALSO TO CITATION(S) 7599

8667 (UCRL—52504) **HCT: a general computer program for calculating time-dependent phenomena involving one-dimensional hydrodynamics, transport, and detailed chemical kinetics.** Lund, C.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Aug 1978. Contract W-7405-ENG-48. 98p. Dep. NTIS, PC E03/MF E03.

A general computer program called HCT is described that is designed to calculate time-dependent problems involving one-dimensional gas hydrodynamics, transport, and detailed chemical kinetics. HCT is designed to handle a wide variety of calculations in the framework of a general "robust" integrator. The difference equations used and the reasoning governing their selection are described in detail. The solution of the difference equation by a generalized Newton's iteration scheme is described. The structure of the coding as implemented on the CDC 7600 at Lawrence Livermore Laboratory is explained. An appendix gives a glossary of the variables needed to run problems. A complete listing of the program is given in a second appendix. Several sample problems are described to illustrate the behavior and capabilities of HCT. A comparison with other programs that calculate similar phenomena is given. 14 figures, 14 tables.

8668 **Program for the determination of adiabatic flame temperatures and composition.** Anthony, E.J.; Powell, M.F. (Build Res Establ, Borehamwood, Hertfordshire, Engl). *Riv. Combust.;* **31**: No. 11-12, 361-370(Nov-Dec 1978).

A computer program which calculates the adiabatic premixed flame temperature for H_2S-CO_2-air mixtures at any initial temperature is described. Full allowance is made for dissociation of the major species into free atoms and radicals. The program has been written in modular form so that it may be easily adapted to other flame systems. In addition, the algorithm used to solve the governing equations has some novel features which are described. 6 refs.

8669 **Time correlation techniques in fire research.** Cox, G. (Fire Res Stn, Build Res Establ, Borehamwood, Hertfordshire, Engl). *Riv. Combust.;* **31**: No. 11-12, 371-378(Nov-Dec 1978).

It is important to be able to predict the rate of smoke and fire spread in buildings in order to optimize the design of escape routes and the siting of detectors and sprinklers. The mathematical procedures available based on turbulence models require experimental guidance. This paper summarizes time correlation and probability techniques being employed at the Fire Research Station in Borehamwood to evaluate the fluctuating nature of experimental fires. Some specimen results are presented concerning mean gas velocities, mean square temperature fluctuations, and combustion probabilities in fire plumes. 8 refs.

8670 **Mathematical models of the transient heat flow to fuel droplets.** Bennett, H.S.; Kayser, R. Jr. (NBS, Inst for Mater Res, Washington, DC). *J. Res. Natl. Bur. Stand.;* **82**: No. 3, 183-195(Nov-Dec 1977).

Two models for the preheat stage of conventional liquid fuel droplets and of emulsified fuel droplets in combustion gases are analyzed theoretically. These models contain the effects of transient heat conduction to the droplets. In the first model, the droplet and gas temperatures vary temporally but only the gas temperature varies spatially; i.e., the droplet temperature is spatially uniform. Numerical examples, computed from this model, for both the droplet and gas temperatures are given. In the second model, both the droplet and gas temperatures vary spatially and temporally. Numerical examples computed from this second model for the surface and average temperature of the droplet are given. These analyses show that the temperature gradients inside droplets of oil and water are small compared to those in the combustion gases near the droplet; that temperature profiles given by both models are very similar. In particular, the predicted times at which micro-explosions are expected to occur agree within 10 percent of each other. 12 refs.

8671 **Propellants.** Ross, D.M. pp 4.74-4.90 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Chemical rocket propellants are described and the general characteristics needed in propellants are outlined. Important propellants and their applications are listed and new approaches to increase the energy level of propellants are discussed. A brief explanation of liquid, solid, and hybrid propellant rockets is included. (JRD)

ENGINEERING

8672 (SAND—77-0750(Vol.3)(No.3)) **Sandia technology.** Craner, R.B.; Garner, W.L. (eds.). (Sandia Labs., Albuquerque, NM (USA)). Sep 1977. Contract EY-76-C-04-0789. 23p. Dep. NTIS, PC A02/MF A01.

Separate abstracts have been prepared for individual items.

FACILITIES AND EQUIPMENT

REFER ALSO TO CITATION(S) 8332, 8849

8673 (UCID—17898) **Using PARET (parameter estimation technique) for the determination of mode shapes.** Lager, D.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Sep 1978. Contract W-7405-ENG-48. 27p. Dep. NTIS, PC A02/MF A01.

The Parameter Estimation Technique (PARET) is applied to the measured responses of a T-shaped aluminum plate to obtain the frequency and damping for the natural resonances and display animated mode shapes for the plate. The measurements consist of the response of an accelerometer mounted on a corner of the plate to hammer blows at 38 separate locations on the plate. PARET is used to compute the natural resonances by determining the parameters of an exponential model that fits the responses. The frequencies and damping for seven modes occurring over a frequency range 500 to 1650 Hz were tabulated and the shape for each mode was plotted.

8674 (UCRL—50053-78-2) **Precision machine-tool program. Quarterly report, May—June 1978.** Sutton, G.P.; Robinson, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Sep 1978. Contract W-7405-ENG-48. 11p. Dep. NTIS, PC A02/MF A01.

During the second quarter of 1978 the initial planning phase of the DOD Tri-Service Precision Machine-Tool Task Force (MTTF) was almost completed. The next phase will begin with a Plenary Session to be held in Scottsdale, Arizona, on October 16 and 17, 1978, where the task force will meet for the first time to review the Plan for Conducting a Precision Machine-Tool Task Force, finalize methods and approaches for its implementation, hold its first working group meetings, and listen to several speeches related to machine tool technology.

8675 (UCRL—50054-78-2) **Precision-machining commercialization. Quarterly report, May—July 1978.** Pearson, J.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Sep 1978. Contract W-7405-ENG-48. 9p. Dep. NTIS, PC A02/MF A01.

During the quarter, plans for the Precision-Machining Commercialization Seminar scheduled for Oct. 26 through 28, 1978 were completed. The plans are reported. (TFD)

8676 **Optimal profile of heat exchanger tube fins.** Lyshevskii, A.S.; Myl'nev, V.F.; Sokolov, V.G. (NPI im. Sergo Ordzhonikidze, USSR). *Energomashinostroenie;* No. 1, 27-29(1978). (In Russian).

Thermal efficiency of single fins mounted on heat exchange tubes is considered analytically. The fins of an arbitrary lateral surface are considered. It is assumed that heat transfer is stationary and that heat conductivity and heat emission coefficients are constant. Computational relations are presented for determining temperature changes in different fin cross sections, the quantity of heat removed by the fins, and its thermal efficiency for different shapes of the lateral surface. Thermal efficiencies of differently shaped fins are compared.

8677 **Aerodynamic characteristics of reactive-type airfoil cascades washed by turbulent flow.** Shpenzer, G.G.; Nosov, V.V. (Leningrad Polytech Inst im. M.I. Kalinin, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 12, 64-68(Dec 1977). (In Russian).

Results of an experimental investigation on a static setup at the Leningrad Polytechnical Institute in a wide range of the angles of attack are presented. The tests were carried out both on aerodynamically smooth and rough airfoils. The effect of turbulence on the magnitude of airfoil and trailing losses is shown.

8678 **4th international electron beam processing seminar.** Silva, R.M. (ed.). Dayton, OH; Universal Technology Corp. (1976). 616p. (CONF-7604150—). $60.00.

From 4. electron beam processing seminar; Long Island, NY, USA (Apr 1976).

Eighteen papers are included in these proceedings of the 4th International Electron Beam Processing Seminar. Topics covered include welding equipment, welding of heavy structures, welding of steel and titanium, welded joints and weld defects, ion plating, and laser cutting. (RWR)

CRYOGENIC AND SUPERCONDUCTING EQUIPMENT AND DEVICES

REFER ALSO TO CITATION(S) 7954, 8329, 8330, 8636, 8818, 9338, 9339, 9342, 9344

8679 (CONF-780952—) **Pressure drop measurement on forced flow cable conductors.** Lue, J.W.; Miller, J.R.; Lottin, J.C. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 3p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

Forced flow cable conductors being developed for use in LCP coils and other large superconducting magnets utilize supercritical helium flowing through narrow, uneven channels with large cooling surfaces. Extensive measurements on pressure drop of a variety of samples were performed. It is found that the friction factor versus Reynolds number plots of all the data are clustered together and behave in a universal way. A factor of two to three higher in friction factor than the smooth tube value in turbulent helium flow regime can be expected for this type of conductor.

8680 (CONF-780952—6) **Analytic solution for the propagation velocity in superconducting composities.** Dresner, L. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 3p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

The propagation velocity of normal zones in composite superconductors has been calculated analytically for the case of constant thermophysical properties, including the effects of current sharing. The solution is compared with that of a more elementary theory in which current sharing is neglected, i.e., in which there is a sharp transition from the superconducting to the normal state. The solution is also compared with experiment. This comparison demonstrates the important influence of transient heat transfer on the propagation velocity.

8681 (CONF-780952—10) **Measurements of traveling transition zone along a superconductor.** Lottin, J.C.; Miller, J.R.; Lue, J.W.; Dresner, L. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

The spatial variation of the temperature in a traveling superconducting-normal transition zone can provide valuable information on transient heat transfer in realistic coil conditions. In this paper, temperature wave curves are presented for several transport currents corresponding to propagation and recovery in a high magnetic field. The temperature profiles have been constructed in the form $T = T(x + vt)$ by measuring the wave velocity and the temperature at one point as a function of time. The temperature is measured directly with differential thermocouples; simultaneous voltage measurements provide a continuous temperature reference in the current sharing region. Information is given about thermocouple calibration in the high magnetic field and about the temperature and magnetic field dependence of the thermal conductivity of the sample.

8682 (CONF-780952—11) **Interaction of transport current and transient external field in composite conductors.** Shen, S.S.; Schwall, R.E. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

Investigations of transient field losses in superconducting composites carrying transport current are presented. The magnetization and terminal voltage of a variety of composites have been measured as a function of transport current and external field. The losses are analyzed as a sum of magnetization losses and those due to dynamic resistivity. Results are presented for slowly changing external fields where the magnetization losses are purely hysteretic and for higher B where coupling losses are important.

8683 (CONF-780952—13) **Measurments of stability of cabled superconductors cooled by flowing supercritical helium.** Miller, J.R.; Lue, J.W.; Shen, S.S.; Lottin, J.C. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

The concept of stability in superconductors cooled by forced flow of supercritical helium is somewhat different from conductors cooled by pool-boiling helium. The crucial point is whether such a conductor can recover from a large deposition of energy before the oxygen is heated to a level that prohibits recovery. In an investigation of stability of forced flow conductors it is usually necessary to use indirect methods of heating the conductor initially, such as by an external pulse coil. However, in using such indirect methods it is essential to determine accurately the time development and magnitude of energy deposition. We use ac loss techniques to examine pulse coil heating and compare those results with extensive measurements on a specially constructed sample containing an embedded heater.

8684 (LA—7374-PR) **Low temperature physics and engineering. Quarterly progress report, January 1—March 31, 1978.** Keller, W.E. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jul 1978. Contract W-7405-ENG-36. 46p. Dep. NTIS, PC A03/MF A01.

This report summarizes the significant progress achieved in several programs carried out in the Los Alamos Scientific Laboratory's Low Temperature Physics and Cryogenic Engineering Group (Q-10) during the period January 1 to March 31, 1978. Progress is documented for the following areas: analysis of environment safety and safety controls for hydrogen; equation of state of solid and fluid hydrogen and deuterium; magnetic studies of solids at low temperature; experiments dealing with the destruction of superconductivity by current; electrical engineering, cryogenic engineering, and cable development aspects leading to a prototype demonstration of a direct current superconducting power transmission line; development of conductors, electrical control apparatus, large Dewar vessels, and magnet coils for superconducting magnetic energy storage devices, as well as designs of these units for power system stabilization; design, testing, and procurement of equipment for separating and handling large amounts of tritium—deuterium mixtures for equipment to be used in conjunction with the magnetic fusion programs; experiments related to target preparation for the laser fusion programs; development of practical conductors of Nb_3Ge; experiments leading to designs for magnetic refrigerators to be used for superconducting device applications in the electric power industry; and theoretical studies of superfluid emulsions. 13 figures, 5 tables.

8685 **Composite multifilament superconductors.** Marancik, W.G. (to Airco, Inc.). US Patent 4,101,731. 18 Jul 1978. Filed date 20 Aug 1976. 8p.

A composite multifilament superconducting structure is described, which includes an elongated substrate-carrying, longitudinally-directed, sputtered discrete filament of an A-15 type intermetallic superconductor. In a preferable procedure, a plurality of spaced, generally longitudinal grooves are formed on the surface of an elongated filamentary substrate, preferably a metal wire. The walls of the grooves on the substrate surface are shaped to undercut the curvilinear surface of the substrate located between two adjacent grooves so that at least some of the wall portions of the grooves are geometrically shadowed during the subsequent sputtering step in which a superconductor is sputtered onto the substrate. In particular, a film of a suitable superconducting intermetallic compound having A-15 crystalline structure, such as Nb_3Ge, is sputtered onto the grooved substrate and deposits at the bottom of the grooves and at the surface portions of the substrate between grooves. The shadowed wall portions remain substantially deposit-free so that the resultant spaced deposits extend as distinct lines or bands along the substrate to thereby constitute the superconductive filaments. A plurality of such substrates may, if desired, be consolidated into a further composite structure, by bundling the substrates and passing same through a molten metal. The resultant structure may then be sized to yield as a final product a composite of the substrates bearing the superconducting filaments in a surrounding matrix of the metal.

8686 **Method of continuous production of super conducting wire.** Miller, G.H. (to Texaco Inc.). US Patent 4,098,920. 4 Jul 1978. Filed date 27 Dec 1976. 8p.

A method of continuously producing a superconductive intermetallic compound is described. It includes passing a filament of a metallic substrate through a high temperature plating chamber. The filament is heated electrically to a higher temperature while plating gases of the metals which make up the intermetallic compound are introduced in the form of halides of such metals along with sufficient hydrogen to complete a chemical change which plates the superconductor on the filament.

8687 **Synchronization of Josephson oscillators by an external monochromatic signal.** Ivanov, N.I.; Yurchenko, I.I. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR, Khar'kov). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 337-339(Mar 1978).

The properties of synchronized Josephson oscillators are studied. The oscillators are single point junctions and chains of series-connected Josephson junctions.

8688 **SQUID with two V—V/sub x/O/sub y/—Pb tunnel junctions.** Rybal'chenko, L.F.; Bondarenko, S.I. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR, Khar'kov). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 339-341(Mar 1978).

The properties of a superconducting quantum interference detector (SQUID) with two V—V/sub x/O/sub y/—Pb tunnel junctions are studied. The properties are stable and reproducible. The SQUID is fabricated by a vacuum-deposition technique in a single cycle without breaking the vacuum in the deposition chamber. Certain anomalies (high incremental current and low Josephson current) characteristic of the vanadium tunnel junctions lead to hysteresis-free voltage—current characteristics at $>$ or $\simeq 4.2$ °K without auxiliary shunts. There are clearly defined interference features on the voltage—field characteristics. Methods for increasing the sensitivity are indicated.

8689 New model for description of the hysteretic RF-SQUID. Krenn, H.; Schmidt, R.; Gross, F. (Graz Univ. (Austria)). *Acta Phys. Austriaca;* **48**: No. 3, 257-266(1978). (In German).

The model, shortly denoted as spiral-model, describes clearly the behavior of a hysteretic RF-SQUID. It employs essentially the complex notation of the tank circuit current. Its momentary value in dependence on time will be marked as a point in the complex plane. Because the RF-SQUID always works in the transient mode the complex vector representing the tank circuit current lies on an exponentially increasing spiral trajectory. At certain critical threshold values the spirals change. The spiral-model is a pure switch-model. The analysis of this dynamic behavior leads to the output characteristics of the RF-SQUID known as conventional step and triangle functions. Considering an application in magnetometry the spiral construction will also be treated in the presence of various magnetic fields in the SQUID. Additionally the model allows taking into consideration the intrinsic noise of the SQUID. It explains the effect of detuning, caused by phase shifts between tank circuit current and voltage.

PROTECTIVE STRUCTURES AND EQUIPMENT

8690 (SAND—78-8647) **Modification and testing of the Sandia Laboratories Livermore tritium decontamination systems.** Gildea, P.D.; Birnbaum, H.G.; Wall, W.R. (Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EY-76-C-04-0789. 32p. Dep. NTIS, PC A03/MF A01.

Sandia Laboratories, Livermore, has put into operation a new facility, the Tritium Research Laboratory. The laboratory incorporates containment and cleanup facilities such that any tritium accidentally released is captured rather than vented to the atmosphere. This containment is achieved with hermetically sealed glove boxes that are connected on demand by manifolds to two central decontamination systems called the Gas Purification System (GPS) and the Vacuum Effluent Recovery System (VERS). The primary function of the GPS is to remove tritium and tritiated water vapor from the glove box atmosphere. The primary function of the VERS is to decontaminate the gas exhausted from the glove box pressure control systems and vacuum pumps in the building before venting the gas to the stack. Both of these systems are designed to remove tritium to the few parts per billion range. Acceptance tests at the manufacturer's plant and preoperational testing at Livermore demonstrated that the systems met their design specifications. After preoperational testing the Gas Purification System was modified to enhance the safety of maintanance operations. Both the Gas Purification System and the Vacuum Effluent Recovery System were performance tested with tritium. Results show that concentraion reduction factors (ratio of inlet to exhaust concentrations) much in excess of 1000 per pass have been achieved for both systems at inlet concentrations of 1 ppM or less.

8691 Standing boiler filter for the adsorptive separation of radioactive vaporous or gaseous impurities from a gas mixture. Neumann, G.M. (to Delbag-Luftfilter G.m.b.H.). German(FRG) Patent 2,218,360/C/. 3 Nov 1977. 8p. (In German).

The invention is to improve upon a standing boiler filter in such manner that no cavities are formed in the region of the filter layer of activated carbon (impregnated with KI or triethyl diamine), that one can easily monitor and control the degree of saturation of the filter layer, and that it is easy to make. This can be achieved by a special design of the inlet or outlet device for the adsorption material to the filter chamber limited by perforated pipes.

8692 Performances of respirator canisters for NaCl aerosol under steady and pulsating-flow conditions. Murata, M.; Ikezawa, Y.; Yoshida, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *Hoken Butsuri;* **12**: No. 3, 167-173(Sep 1977). (In Japanese).

An experiment was made to test the performances of respirator canisters under both steady and simulated respiratory flow conditions, using a mechanical breathing simulator and a NaCl aerosol as the test aerosol. Eighteen commercially available, imported and domestic canisters were tested. Efficiencies and inhalation resistances of the canisters are summarized as a function of inspiratory flow rates for both test flow conditions. Increases in penetration and resistance under the pulsating flow were observed and were compared with those under the steady flow conditions at the same minute volume. Based on the data, a simplified method is proposed for roughly estimating performance under respiratory pulsating flow through a steady flow measurement. A comparison is also made between the present results and the nominal efficiency of each canister.

HANDLING EQUIPMENT AND PROCEDURES

8693 Calculations of UH_3 critical masses for various uranium enrichments. Lewis, F.H. (Univ. of California, Livermore); Soran, P.D. *Nucl. Sci. Eng.;* **68**: No. 1, 116-125(Oct 1978).

Monte Carlo neutron transport calculations of critical radii of bare UH_3 spheres as a function of ^{233}U and ^{235}U enrichment in ^{238}U were carried out using three different calculational methods: (1) the continuous-energy method; (2) the multigroup approximation; and (3) the probability table method. Also calculated were the average neutron removal lifetimes and median fission-producing neutron energies for these critical systems. Results of these calculations were analyzed and compared to quantify and bound self-shielding effects arising from the neutron cross-section resonances in calculating these moderated critical assemblies. Although the critical radii of these assemblies are sensitive to the resonances in ^{238}U, the removal lifetime seems to be affected much more by the fissile isotope resonances. The probability table method gives results that are in excellent agreement with continuous-energy calculations, thereby eliminating the need for special cross-section processing for each separate enrichment when using multigroup cross sections.

8694 Integral version of the Los Alamos density exponent formula for critical mass variation. Kumar, A.; Srinivasan, M. (Bhabha Atomic Research Centre, Bombay (India). Neutron Physics Section). *Atomkernenergie;* **31**: No. 4, 249-251(1978).

This paper makes an attempt to extend the validity of the well-known Los Alamos Density Exponent Formula (LADEF) for the variation of critical mass of reflected spherical systems with core/reflector density changes to a wide range of density variations by appropriately integrating the original formula. The equation derived is $Y = X\text{supa}\alpha/(\Delta_0 + X\text{supa}\alpha)$ where X is the relative variation of core density with respect to that of reflector; α is a constant of system independent of density; Y denotes the ratio of reflected critical core radius to unreflected critical radius, $\Delta_0 = (1-Y_0)/Y_0$ with Y_0 pertaining to a reference system where $X = X_0 = 1$. A detailed comparison with more exact calculations using a multigroup one-dimensional transport theory code is made over a five decade density variation range taking as example a Pu-Be system. The justification for integration, range of validity of the integral formula (ILADEF) and its physical interpretation are discussed. The possible applications and some of the limitations of ILADEF are also pointed out.

SHIPPING CONTAINERS

REFER ALSO TO CITATION(S) 7487, 7514

8695 (BMI—2001) **Experimental studies of dynamic impact response with scale models of lead shielded radioactive material shipping containers.** Robinson, R.A.; Hadden, J.A.; Basham, S.J. (Battelle Columbus Labs., OH (USA)). 29 Sep 1978. Contract W-7405-ENG-92. 168p. Dep. NTIS, PC A08/MF A01.

Preliminary experimental studies of dynamic impact response of scale models of lead-shielded radioactive material shipping containers are presented. The objective of these studies is to provide DOE/ECT with a data base to allow the prediction of a rational margin of confidence in overviewing and assessing the adequacy of the safety and environmental control provided by these shipping containers. Replica scale modeling techniques were employed to predict full scale response with 1/8, 1/4, and 1/2 scale models of shipping containers that are used in the shipment of spent nuclear fuel and high level wastes. Free fall impact experiments are described for scale models of plain cylindrical stainless steel shells, stainless steel shells filled with lead, and replica scale models of radioactive material shipping containers. Dynamic induced strain and acceleration measurements were obtained at several critical locations on the models. The models were dropped from various heights, attitudes to the impact surface, with and without impact limiters and at uniform temperatures between -40 and 175°C. In addition, thermal expansion and thermal gradient induced strains were measured at -40 and 175°C. The frequency content of the strain signals and the effect of different drop pad compositions and stiffness were examined. Appropriate scale modeling laws were developed and scaling techniques were substantiated for predicting full scale response by comparison of dynamic strain data for 1/8, 1/4, and 1/2 scale models with stainless steel shells and lead shielding.

8696 (LA—7469-MS) **Cargo response to railcar impact and tiedown load analysis.** Bartholomew, R.J. (Los Alamos Scientific

Lab., NM (USA)). Sep 1978. Contract W-7405-ENG-36. 57p. Dep. NTIS, PC A04/MF A01.

An analytical study of the loads produced during coupling of railcars carrying heavy shipping containers is presented. The structural model of the impact event is represented by a lumped-parameter technique. Each discrete mass lump possesses longitudinal, vertical, and rotational degrees of freedom. The resulting computer simulation provides for nonlinear railcar coupler stiffness and linear damping forces in the coupler and container tiedowns. Results include response to parametric variations in container weight, impact speed, and tiedown stiffness. Container dynamic response and tiedown loads are found to depend heavily on these parameters. Also, railcar bending and subsequent vertical motion are shown to be important contributors to these responses. When experimentally substantiated, the model developed can serve as a useful tool in the design and evaluation of shipping container tiedown structures.

8697 (NUREG/CR—0373) **Impact tests on inclined stainless steel fins.** Sagartz, M.J. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 19p. (SAND—78-0197). Dep. NTIS, PC A02/MF A01.

Stainless steel fin models inclined at a 10-degree angle with respect to the direction of impact were tested at Sandia Laboratories drop table test facility. Force transducer and accelerometer data gave load-time and acceleration-time data from which the peak impact force and absorbed energy were obtained. Results of the tests showed that the peak dynamic load on a 10-degree fin due to a 13.4 m/s (44 f/s) impact can be more than three times its static load capacity and that 10-degree fins deform by buckling rather than by bending over. The energy-absorbing capacity of 10-degree fins showed some decrease but no dramatic difference when compared with similar fins that were impacted normally.

8698 (SAND—78-0724(Rev.)) **Plutonium accident resistant container project.** Andersen, J.A. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 32p. Dep. NTIS, PC A03/MF A01.

The PARC (plutonium accident resistant container) project resulted in the design, development, and certification testing of a crashworthy air-transportable plutonium package (shipping container) for certification by the USNRC (Nuclear Regulatory Commission). This PAT-1 (plutonium air transportable) package survives a very severe sequential test program of impact, crush, puncture, slash, burn, and water immersion. There is also an individual hydrostatic pressure test. The package has a payload mass capacity of 2 kg of PuO_2 and a thermal capacity of 25 watts. The design rationale for very high energy absorption (impact, crush, puncture, and slash protection) with residual high-level fire protection, resulted in a reasonably small air-transportable package, advancing the packaging state-of-art. Optimization design iterations were utilized in the areas of impact energy absorption and stress and thermal analysis. Package test results are presented in relation to radioactive materials containment acceptance criteria, shielding and criticality standards.

8699 (SAND—78-1288C) **Solid neutron shield development.** Allen, G.C. Jr.; Curl, M.L.; Freedman, J.M.; Pope, R.B.; Sutherland, S.H. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 5p. (CONF-781105—35). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Solid neutron shields for use on Breeder Reactor Spent-Fuel Shipping Casks (SFSC) are being developed by Sandia Laboratories, Albuquerque, New Mexico. A number of different solid neutron shield materials are being evaluated which could be used to attenuate neutrons in various nuclear material transportation systems. A SFSC must be capable of surviving a series of design basis accidents (of which the fire would likely have the most severe effect on a neutron shield) with a degradation of shielding ability less than a factor of about one hundred. One basis of determining a preferable solid neutron shield material is to compare the neutron attenuation of the materials after being subjected to fire. Other bases include shielding efficiencies, costs, and mechanical properties. The materials currently being assessed as solid neutron shields for shipping casks are listed. The list includes one material that will remain undamaged and others that will degrade in a fire accident environment. The data base for the comparison of the materials is being compiled.

8700 **Subcriticality guidelines for liquid-metal fast breeder reactor spent fuel shipping cask designs.** Philbin, J.S.; Dupree, S.A. (Sandia Labs., Albuquerque, NM). *Nucl. Technol.;* **40**: No. 3, 284-296(Oct 1978).

A series of three-dimensional Monte Carlo criticality calculations has been performed to examine the criticality problems that exist in liquid-metal fast breeder reactor spent fuel shipping casks. The reactivity effects of subassembly loading sequences, total fuel payloads, subassembly pitches, neutron poisons, and choices of cask coolants and structural materials were considered. The analyses showed that, for a given type of fuel, the system k/sub eff/ can be displayed in a manner that permits determination of the maximum number of subassemblies that can be safely loaded in a particular cask. For a given cask coolant, this maximum number can be fixed independent of (1) the sequence or positions in which the subassemblies are loaded; (2) the detailed design of the basket supporting the subassemblies, including small changes in the distance between the subassemblies; and (3) changes in the cask design outside the fuel region. Thus, the shielding, structural, and thermal problems inherent in the design of the outer cask structure can be addressed without reference to the criticality problem.

8701 **Safe transportation of hazardous materials.** Gablin, K.A.; Hansen, L.J. (to Nuclear Engineering Co., Inc.). US Patent 4,100,860. 18 Jul 1978. Filed date 26 Nov 1973. 16p.

A shipping container overpack for safe transportation of radioactive and other hazardous materials provides a leakproof receptacle for containing and protecting the material to be shipped against accidental release and dispersal into the surrounding environment. The receptacle is of conventional size and shape for shipping containers and has spaced inner and outer shells with a layer of foamed polyurethane occupying the space therebetween to provide sealing, insulation and reinforcement. The polyurethane foam is rigidly compressible and adheres to and reinforces the spaced inner and outer shells to provide a stress skin structure. Gusset plates are secured to the inner surface of the outer shell in covering relation to the corners and edges, defining a reinforcing framework of triangular cross-section tubular elements. Relatively rigid polyurethane foam is contained within the tubular elements to add further reinforcement and redundant sealing capacity.

8702 **Transport vessel for a radioactively contaminated and/or activated component.** Bock, A.; Stuermer, H. (to Steinmueller (L. u. C.) G.m.b.H.). German(FRG) Patent 2,408,952/C/. 17 Nov 1977. 2p. (In German).

The transport of differently shaped components of a nuclear reactor presents difficulties if these components have been contaminated. A container permitting safe transport of such components was developed. Top and bottom of the container are closed by sealing and quick-action elements. The top is designed as a bell-shaped, self-supporting lifting appliance; its side wall consists of pieces interlocking telescope-like, its dimensionning thus being very variable. By the safe closure, radiation damage is excluded; an additional shielding with lead could be of advantage.

TRANSPORT AND STORAGE FACILITIES

8703 **Study on the optimization of material handling system in bulk storage yards.** Kohama, Y.; Nonoue, T.; Nagamori, N.; Murata, I.; Miyamoto, K. *Tech. Rev., Mitsubishi Heavy Ind.;* **15**: No. 2, 130-139(Jun 1978).

The working condition of a ship which plays an important part in the determination of the capacities of a shipyard and the material handling machinery are analyzed by the waiting queue theory. However, the theory becomes too complicated to apply for a shipyard composed of two or more berths and there was no other way but to analogize the conditions from analytical results of the ports with one berth only. Furthermore, no large scale yard has been planned with consideration of the method of efficient storage of several kinds of materials. A discreet simulation system was developed which can solve these problems by applying the control theory and linear programming theory, the feature of which can effectively determine the following six terms: capacity of a yard; layout of the yard; capacity of material handling machinery; arrangement of material handling machinery; method of management of the system; and planning. The optimization method and the simulation method for analyzing these problems are described.

MINING AND DRILLING EQUIPMENT AND FACILITIES

8704 **Wearing of rockdrill metals: how to ease the problem.** Adamson, M.G.; Cooper, R.; Perel, B. (Boart Res Lab). *S. Afr. Min. Eng. J.;* **89**: No. 4139, 62-63, 65, 67, 69, 59(Apr 1978).

The inservice deterioration of some rockdrill components, the drill rods and hard-metal inserts are considered.

8705 **Analytical study of the thermal conditions and determination of the basic parameters of a synthetic mining microclimate 'drift-chamber' complex.** Shcherban, A.N.; Braicheva, N.A.; Chernyak, V.P.; Zolotarenko, Yu.P.; Shiryaev, A.A. *Teplofiz. Teplotekh.;* No. 32, 7-11(1977). (In Russian).

Methods were worked out for the thermal designing of forced, suction and combined ventilation systems for underground installations consisting of an experimental chamber and long transport drift whose cutting and operation is conducted at high rock temperature. Basic principles are presented for methods of forecasting and the results of forecasting temperature and relative humidity and determining the parameters of air conditioning in mining installations.

8706 Approximation of process parameters in borehole drilling by the fusion method. Shcherban, A.N.; Chernyak, V.P.; Mil'kovitskii, S.I.; Okunev, M.Sh. *Teplofiz. Teplotekh.;* No. 32, 55-58(1977). (In Russian).

A method is worked out for approximating process parameters (rate of drilling, radius of borehole) during the drilling of boreholes in highly heated rock by the fusion method. To solve the calculation equation the total expenditure of thermal energy in the facing is presented in the form of the sum of its individual expenditures, i.e., the energy expended for melting the massif, for heating it as conditioned by the heat transfer through the fusion layer. The relationship between unknown magnitudes for real conditions was found as a result of a numerical solution.

8707 Ekspluatatsiya peredvizhnykh linii elektroperedach na kar'erakh. (Operation of mobile electrical lines to mines). Dubinskii, I.M. Moscow; Nedra (1976). 106p.

A description is given of mobile electrical transmission and cable lines. A sequence of operations is given for performing installations, inspections, preventive measures and tests. A method is presented for finding damages and repair methods. An examination is made of basic rules of technical safety for reducing accidents and electrical shock injuries. The book is intended for mine electricians servicing mobile electrical circuits.

LASERS

REFER ALSO TO CITATION(S) 9358

8708 (COO—2811-1) **Visible laser energy transfer study. Final technical report.** Mandl, A. (Avco-Everett Research Lab., Everett, MA (USA)). Mar 1977. Contract EY-76-C-02-2811. 31p. Dep. NTIS, PC A03/MF A01.

Two sets of measurements were carried out using a new apparatus. In both sets of measurements Xe resonance radiation (147 nm) was used to optically excite Xe in a reaction cell. In one set of measurements the optically pumped Xe (Xe*) reacted with a fluorine compound to form XeF* while in the second set of measurements the Xe* is reacted with N_2 to form $N_2(A^3\Sigma^+$/sub u/) which is a metastable level of N_2. The $N_2(A^3\Sigma^+$/sub u/) is used as a source for energy transfer to other species. A separate abstract was prepared for each of the two measurements. (TFD)

8709 (COO—2811-1, pp 3-11) **Device for optically exciting XeF and other rare gas excited complexes.** Mandl, A.; Ewing, J.J. (Lawrence Livermore Lab., CA). Mar 1977.

In Visible laser energy transfer study. Final technical report.

A device is described in which Xe is optically pumped (147 nm) and reacted with NF_3 to form XeF. The same apparatus can be used to pump Kr and Ar and thereby form excited rare gas halides, oxides and sulphides. The device is small, allowing repetitive pulsing and signal averaging techniques to be used.

8710 (COO—2811-1, pp 12-28) **Quenching of $N_2(A^3\Sigma$/sub u/$^+$) by I_2.** Mandl, A.; Ewing, J.J. (Lawrence Livermore Lab., CA). Mar 1977.

In Visible laser energy transfer study. Final technical report.

Production and decay of $N_2A^3\Sigma^+$/sub u/ (v = 0, 1, 2) states were monitored photoelectrically from the sensitized fluorescence of NO γ-bands. These states were produced by collisional transfer from excited Xe ($1S_4$) which in turn was produced by radiative energy transfer via resonance radiation (147 nm) from a closely coupled Xe flash lamp. The rate coefficient for the deactivation of $N_2(A^3\Sigma^+$/sub u/) by I_2 was measured as k/sub I_2/ = 6.9 +- 1.9 x 10^{-12} cm^3/sec. The deactivation by NO itself was measured as k/sub NO/ = 4.5 +- 0.5 x 10^{-11} cm^3/sec.

8711 (COO—4275-2) **Metal vapor excimer laser. Quarterly progress report, August 1, 1977—October 31, 1977.** Kovacs, M.A.; Jacobs, J.H. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Dec 1977. Contract ES-77-C-01-4275. 27p. Dep. NTIS, PC A03/MF A01.

Some of the constraints on achieving a quasi-stable discharge were investigated by modeling and simplified calculations. The fabrication and initial testing for much of the experimental equipment has been completed. The efforts are detailed in the two major sections of this report.

8712 (COO—4275-4) **Metal vapor excimer laser. Quarterly progress report, February 1, 1978—April 30, 1978.** Kovacs, M.A.; Jacobs, J.H. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Jun 1978. Contract ES-77-C-01-4275. 36p. Dep. NTIS, PC A03/MF A01.

Major effort was expended in the final assembly of the gain experiment apparatus; this phase had been delayed by some magnet and discharge tube problems which have now been solved. The addition of the discharge circuitry, now underway, is the last step before gain and discharge tests. The metal testing oven is complete and preliminary tests are underway which show encouraging results concerning the compatibility of mercury vapor and Inconel and 316 SS. Some initial modeling was done with the Boltzmann/kinetics code which demonstrates CdHg* production efficiency as a function of E/N.

8713 (NRL-MR—3848) **CGE rod amplifier modules.** McMahon, J.M. (Naval Research Lab., Washington, DC (USA)). Aug 1978. Contract ES-77-A-01-6021. 23p. Dep. NTIS, PC A02/MF A01.

The performance and development history of the neodymium glass laser rod amplifiers in use at NRL on the Pharos II laser system is reviewed. The impact of possible future modifications is assessed.

8714 Angular multiplexing as a technique for short-pulse amplification in a high-gain xenon amplifier. Sandoval, R.P. (Sandia Laboratories, Albuquerque, New Mexico 87185). *J. Appl. Phys.;* **49**: No. 12, 5745-5749(Dec 1978).

It has been proposed that the technique of angular multiplexing could provide an efficient scheme for extracting short pulses from a high-gain laser with a high degree of spatial and temporal control of the extracted laser beam. The scheme of angular multiplexing proposes to amplify short laser pulses (~1 nsec) by sequentially passing these pulses through the amplifier at slightly different angles. The intensity of each pulse must be sufficient to control amplified spontaneous emission and to extract a significant fraction of the available energy. The experimental demonstration of this technique on the high-gain xenon laser is described here. The measurements were made for a two-pulse train with each pulse width shorter than the amplifier gain period. The results of this experiment indicate that for an optimum pulse separation and input pulse intensity, a major fraction of the available laser energy could be extracted efficiently by the pulse train without significant pulse distortion.

8715 Secondary laser cavity for weak absorptions. Kyle, T.G.; Schuster, B.G. (University of California, Los Alamos Scientific Laboratory, Health Division, Industrial Hygiene Group, Los Alamos, New Mexico 87545). *Appl. Opt.;* **17**: No. 17, 2659-2660(1 Sep 1978).

It is demonstrated that two optical cavities can be created with three mirrors by using one mirror surface as the interface. The secondary cavity behaves as a multipass absorption cell.

8716 Generation of intense subnanosecond 0.58—0.80-μm pulses with a flashlamp-pumped dye laser. Negran, T.J.; Glass, A.M. (Bell Laboratories, Murray Hill, New Jersey 07974). *Appl. Opt.;* **17**: No. 17, 2812-2816(1 Sep 1978).

Subnanosecond optical pulses (as short as 7 psec) have been generated over the 0.58-0.80-μm wavelength range with good beam quality, energies in excess of 1 μJ/pulse (up to 20μJ/pulse), and repetition rates of at least 10 Hz using a flashlamp-pumped dye laser. The experimental details concerned with mode locking the dye laser and the selection of single pulses from the pulse train with an energy reproducibility of 10% are described.

8717 Method of and arrangement for producing coherent mode radiation. Russer, P. (to Licentia Patent-Verwaltungs-GmbH). US Patent 4,101,845. 18 Jul 1978. Priority date 29 Mar 1975, German, Federal Republic of (F.R. Germany). 14p.

The method of producing coherent mode radiation comprises passing direct currents through a pair of injection lasers optically coupled together but controllable separately, one laser of good optical quality (O-factor) and spectral purity being excited above its threshold and the other laser having a lower optical quality and having a modulated current superimposed on its dc current. An arrangement suitable for carrying out such a method is also provided.

8718 Gas laser. Fein, M.E.; Salisbury, C.W. (to Owens-Illinois, Inc.). US Patent 4,101,846. 18 Jul 1978. Filed date 16 Jul 1976. 18p.

The invention discloses a gaseous laser, whose cathode is a conductive coating upon the walls of a cathode volume, the geometric design of the cathode, cathode volume, and cathode-connecting volume being such as to impede sputtering of the cathode.

8719 Laser control circuit. Albanese, A. (to Bell Telephone Labs., Inc.). US Patent 4,101,847. 18 Jul 1978. Filed date 1 Nov 1976. 6p.

The operating current level of an injection laser is stabilized at a point of maximum linearity. A test signal modulates the laser current, and the operating current level of the laser is automatically adjusted until the harmonic distortion component in the output light at twice the test signal frequency is minimized.

8720 Method for exciting a gas dynamic CO_2 laser and apparatus for performing the method. Born, G.; Hermansdorfer, H.; Sepp,

G.; Grosch, G. (to Messerschmitt-Bolkow-Blohm GmbH). US Patent 4,100,507. 11 Jul 1978. Priority date 28 Feb 1976, German, Federal Republic of (F.R. Germany). 6p.

A method of exciting a gas dynamic CO_2 laser, especially at high stagnation temperatures above 2500°K and at a combustion chamber pressure above 50 bar, is described. A liquid fuel and a liquid oxidizer are injected into the combustion chamber at these operating parameters and the produced laser gas is caused to flow through a Laval nozzle into a resonator. The flow cross sectional area of the Laval nozzle adjacent to the resonator is at least 100 times larger than the flow cross sectional area adjacent to the nozzle neck facing the combustion chamber. The flow of the laser gas through this nozzle cools the gas to about 300°K, whereby an inversion state is produced. The laser for performing this type of operation has a combustion chamber connected through the above mentioned nozzle to a resonator which in turn is connected to a diffuser. A tank for liquid fuel and a tank for a liquid oxidizer are connected to the respective injection nozzles of the combustion chamber, whereby the respective conduits preferably extend through cooling jackets of the combustion chamber of the diffuser.

8721 Multilayer reflector for gas discharge laser. van der Wal, J.; Gielens, W.A.M.; Pasmans, J.M.M. (to U.S. Philips Corp.). US Patent 4,099,840. 11 Jul 1978. Priority date 2 Oct 1975, Netherlands. 4p.

The invention discloses a multilayer reflector of which the last layer most remote from the substrate and having a high refractive index is vapor-deposited from a mixture containing a metal or oxide of an element from group 4b of the periodic table and a metal oxide from the group of beryllium oxide, magnesium oxide and calcium oxide, is particularly resistant to hydrogen and ultraviolet light and is hence suitable for application in a laser which is to have a long life.

8722 Dyestuff laser. Walther, H.; Hartig, W.; Friedrich, A.; Raue, R. (to Bayer Aktiengesellschaft). US Patent 4,100,509. 11 Jul 1978. Priority date 4 Jul 1975, German, Federal Republic of (F.R. Germany). 6p.

A process is described for generating coherent frequency-variable monochromatic radiation (laser light) by means of a dyestuff laser which consists of a reservoir for the dyestuff solution and an energy source, connected thereto, which is capable of exciting the dyestuff solution to emit, the radiation generated being in the wavelength range from 550 to 680 nm.

8723 Chemically fueled laser. Jeffers, W.Q.; Kelley, J.D.; Wiswall, C.E. (to McDonnell Douglas Corp.). US Patent 4,099,138. 4 Jul 1978. Filed date 12 Jan 1976. 4p.

The application relates to fuel for a chemical laser in which carbon monosulfide (CS) is reacted with oxygen atoms (O) to fuel a carbon monoxide (CO) chemical laser. The use of carbon monosulfide results in faster pumping of the laser, less heating of the medium, and a lessened need for oxygen atoms in the system.

8724 Free jet laser amplifier. Pike, C.T. (to Jersey Nuclear-Avco Isotopes, Inc.). US Patent 4,099,131. 4 Jul 1978. Filed date 2 Sep 1975. 6p.

A free jet dye laser having a sheet of fluent laser material bounded along its edges by a pair of opposed guide members is described. An orifice injects the sheet of laser fluid into the region between the guide members where it flows towards a transparent portion of the guide members through which a beam of laser radiation to be amplified is directed. Pump excitation in the form of laser energy is applied through an exposed surface of the flowing laser material in the region between the transparent portions.

8725 Laser generator. Leblanc, M.; Ripart, G.; Brule, A. (to Compagnie Industrielle des Lasers). US Patent 4,099,141. 4 Jul 1978. Priority date 3 Apr 1975, France. 6p.

A laser generator is described. The generator comprises an optical resonant cavity of the folded type, limited by two plane mirrors arranged in a same plane, side by side and a corner cube reflector for sending back the radiation coming from one of the mirrors towards the other mirror. Application to telemeters and to illuminators are described.

8726 Chemical laser process and apparatus. Snelling, D.R.; Suart, R.D.; Foster, K.D. (to Minister of National Defence). US Patent 4,099,140. 4 Jul 1978. Priority date 14 Mar 1975, Canada. 20p.

A continuous flow chemical laser is described in which chlorine dioxide and nitric oxide are reacted to produce atomic chlorine and hydrogen iodide is then introduced into the flow stream to form hydrogen chloride in an excited state. The hydrogen chloride may itself be lased in a transverse flow laser or carbon dioxide may be introduced which may be lased in a longitudinal or transverse flow laser. The required chlorine dioxide may be generated by passing chlorine and helium or another inert gas through loosely packed sodium chlorite. The nitric oxide may be introduced in two successive steps first to yield chlorine monoxide and in the second stage to yield atomic chlorine. The latter reaction facilitates operation in the supersonic transverse flow mode in which the hydrogen iodide and second injection of nitric oxide are made just as the flow stream is being transformed from a subsonic flow rate to supersonic flow rate.

8727 Continuously tunable pulsed neodymium laser. Makogon, M.M.; Solodov, A.M. (Institute of Atmospheric Optics, Siberian Branch, Academy of Sciences of the USSR, Tomsk). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 125-126(Mar 1978).

A photographic method using Fabry-Perot interferometers was employed to study the output spectum of a Nd laser for various rates of change of the ring cavity length. (AIP)

8728 Spatial distribution of the intensity fluctuations of a gas laser. Akchurin, G.G.; Rabinovich, E.M.; Tuchin, V.V. (N. G. Chernyshevskii Saratov State University; Scientific-Research Institute of Mechanics and Optics). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 128-130(Mar 1978).

Laser radiation modulation is measured for the output from He-Ne and CO_2 lasers. (AIP)

8729 Stabilized single-frequency travelling-wave YAG:Nd^{3+} laser. Andreev, P.A.; Gusev, A.A.; Kruzhalov, A.V.; Pakhomov, L.N.; Petrun'kin, V.Y. (M. I. Kalinin Polytechnical Institute, Leningrad). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 137-138(Mar 1978).

The stabilization of a continuously pumped semiconductor laser with a ring cavity in standing wave operation is reported.(AIP)

8730 Characteristics of sealed-off high-pressure CO_2 laser amplifier. Gonchukov, S.A.; Kornilov, S.T.; Protsenko, E.D.; Tronin, A.Y. (Moscow Engineering Physics Institute). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 327-328(Mar 1978).

The gain on the P (20) transition of the CO_2 molecule is measured in a sealed-off high-pressure CO_2 laser amplifier. The amplifier is a discharge tube of beryllium oxide with a square cross section, which is water cooled at room temperature. The gain is given as a function of the discharge current, the cross-sectional area, and the pressure and composition of the gas mixture. The data are compared with the theory.

8731 Optically pumped pulsed laser with a mixture of mercury (λ=546.1 nm) and nitrogen. Znamenskii, V.B. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 2, 244-245(Feb 1978).

Calculations are performed on the possibility of creating a population inversion in HgI when a Hg-N_2 mixtures is excited by blackbody radiation. (AIP)

8732 Minimum of a ring laser capture zone in a dynamic beat system. Kutsak, A.A.; Kruglik, G.S. *Zh. Prikl. Spektrosk.;* **27**: No. 6, 988-992(Dec 1977). (In Russian).

Solutions for a modified phase equation which describes the frequency characteristics of a ring laser with a fluctuating "support" were found within the framework of a modified averages method. A minimum of the capture zone which differs from zero was shown to exist during a sinusoidal change of the support in a dynamic beat system and is determined by the relaxation parameter. The relaxation parameter leads to a certain decrease in the capture area at an arbitrary ratio of amplitude and switch-over period in the event of commutation of the support. The minimum value of the capture area (if the condition of phase difference continuity at the moment of commutation is satisfied) is zero, as follows from the solution of the simplified phase equation.

8733 Dye lasers with distributed feedback. Rubinov, A.N.; Efendiev, T. Sh. *Zh. Prikl. Spektrosk.;* **27**: No. 4, 634-646(Oct 1977). (In Russian).

A review is made of original research and development of dye solution lasers with distributed feedback (DF) and induced pumping. An examination is made of the effect that the spectral and angular structure of pumping emission have on the degree of monochromaticity and stability of a DF laser's generation frequency. An examination is made of various methods of restructuring the generation line of a DF laser in dyes. The contribution made by a thermal phase lattice to the formation of generation in a BF laser was studied. A frequency generation system for DF dye lasers (up to 100 cps) was completed. The possibility of a frequency system for liquid lasers with DF and induced pumping is based on the small relaxation time of the phase and amplitudinal lattices which appear in the solution. An analysis and experimental study were made of the simultaneous generation conditions for a DF laser on two or more frequencies in the presence of a corresponding number of spectral components in the pumping emission as well as in monochromatic pumping. A generation system was obtained for ultra-short emission impulses during the pumping of a DF laser by the basic frequency of a ruby laser with forced modal synchronization. An experimental sample of a DF laser device was worked out on the basis of the

completed studies which makes it possible to operate both in a system of singular impulses and with a frequency of secondary impulses up to 100 cps as well as during pumping by a train of ultra-short impulses. An even restructuring of the narrow generation line in the entire spectral band of 400 to 1000 nm was accomplished when the second harmonic and basic ruby frequency were used for pumping.

8734 Spectral dynamics of luminescence and its effect on the spectrum of laser generation. Morgun, Yu.F.; Muravitskii, M.A.; Ryzhechkin, S.A. *Zh. Prikl. Spektrosk.;* 27: No. 4, 697-703(Oct 1977). (In Russian).

An experimental study was made of changes in the spectral width of the contour of amplified ruby luminescence in the pre-generation period. Recordings were made for the first time of luminescent types of ruby oscillations which appear in the pre-generation period. As illustrated by lasers with various quality modulators (clarifying filter, optico-mechanical and electro-optical shutter), the spectral contour of amplified luminescence formulated at the beginning of generation was shown to affect the spectral characteristics of the emission being generated. Conditions for significantly narrowing the contour of amplified luminescence at the pre-generation stage must be created in order to obtain emission with a high degree of spectral clarity.

8735 Injection laser with an external dispersion resonator as a source of narrow-line restructured emission. Bakhert, Kh.Yu.; Bogatov, A.P.; Eliseev, P.G.; Kler, A.; Man'ko, M.A.; Strakhov, V.P. *Zh. Prikl. Spektrosk.;* 26: No. 6, 988-992(Jun 1977). (In Russian).

A study was made of the influence of an external dispersion resonator on the spectral restructuring of an injection laser. An examination was subsequently made of a laser diode—collimating optics—diffraction lattice system. In order to suppress generation in the resonator formed by natural semiconductor crystal facets, a clarifying cover was applied to one of the facets or it was polished at an angle towards the p-n transition plane. The width of the generation line in such a laser is determined by the spectral selectivity of the dispersion resonator and comes to 0.004 nm, and the output reaches 5 watts. The interval of spectral restructuring during optimal feedback is equal to 20 nm. A study was made of the parameter stability of a laser with a dispersion resonator with respect to mechanical disturbances.

8736 Bisantens: substances for phototropic quality modulators of ruby lasers. Gorelenko, A.Ya.; Tolkachev, V.A.; Khalimanovich, D.M. *Zh. Prikl. Spektrosk.;* 26: No. 6, 993-995(Jun 1977). (In Russian).

Effective phototropic quality modulators for a ruby laser were made from solutions of 4, 11 diphenylbisanten (DPB) and 4, 11-diacetooxybisanten (DAB). A monoimpulse generation system was accomplished with a semi-width of 10 to 20 nsec and an emission density of about 200 MW. cm^2 (DPB solution in toluene) and a modal autosynchronization circuit (solutions in bromine-benzene). DPB is close to gallium chlorophthalocyanine with respect to photostability.

8737 Comparative studies of dye laser pumping by tubular and coaxial flash tubes. Basov, Yu.G.; Sil'nitskii, A.F. *Zh. Prikl. Spektrosk.;* 26: No. 6, 996-999(Jun 1977). (In Russian).

The superiority of coaxial tubes, accomplished primarily by significantly reducing the impluse duration of the light's intensity, was demonstrated in a study of the comparative efficienty of dye laser pumping by coaxial and tubular tubes utilized in a low-induction discharge circuit at a pumping energy of 10 to 20 J.

8738 High frequency automodulation of emissions by a laser with an unstable cavity. Lebedev, V.I.; Yurevich, V.A.; Yasen, A.I. *Zh. Prikl. Spektrosk.;* 26: No. 6, 1000-1008(Jun 1977). (In Russian).

An experimental study was made of the generation kinetics of an impulse ruby laser with unstable and adjusted cavities in a broad change band of emission output. The output emission of such a laser contains, along with the appearance of giant impulses, more high frequency pulsations which follow in phase with a short by-pass time by the cavity's light—supershort impulses. The number of supershort impulses on the cavity's phase was shown to depend on the position of the ruby in the cavity, and the impulses' amplitude is associated with the degree of the cavity's initial stability, but their appearance occurs when a change takes place in the rise velocity of generation output. A computerized numerical computation was made of the time characteristics of emission in a laser with a self-modulating quality cavity. The mechanism of rapid loss changes is the relationship between the ruby refraction index and the population density of energy levels and associated lens. The computations confirmed the basic observed characteristics within the framework of the adopted laser model. The obtained data therefore indicate that auto-modulating emission in a laser cavity can lead to the appearance of ultra-short impulses.

8739 Certain features of the spectral-kinetic characteristics of a ruby sweep generator. Gulev, V.S.; Pivtsov, V.S.; Folin, K.G.; Chernyshev, A.I. *Zh. Prikl. Spektrosk.;* 26: No. 6, 1012-1016(Jun 1977). (In Russian).

A study was made of the spectral-kinetic characteristics of emission in a ruby sweep generator with a levelling of axial inversion non-uniformity in the TEM/sub OOq/ modal circuit. The effect of sweeping velocity and axial inversion non-uniformity on the indicated characteristics of the generator was clarified. The laser was found to be highly sensitive to selection and absorption within the cavity.

8740 Free electron laser. Kwan, T.; Dawson, J.M.; Lin, A.T. (Univ. of California, Los Angeles). pp 486-506 of Plasma physics: nonlinear theory and experiments. Wilhelmsson, H. (ed.). New York; Plenum Press (1977).

From Nobel symposium on nonlinear effects in plasmas; Lerum, Sweden (11 Jun 1976).

The possibility of a new type of laser was investigated by computer simulation using a 1-2/2 dimensional fully relativistic electromagnetic particle code. By passing a relativistic electron beam over a rippled static magnetic field, high frequency electromagnetic radiation is generated. If the ripple wavelength is $lambda_0$, the lasing wavelength is roughly $lambda_0/2\gamma^2$. Thus such a laser is continuously tunable by varying γ. It was found that as much as 35% of the beam energy can be converted into radiation, of which as much as nearly 90% can be in the most rapidly growing mode. A theory of the coupling between the negative energy plasma wave and electromagnetic radiation by means of the rippled magnetic field is presented. Good agreements were obtained between the simulation and the theory. The saturation mechanism is found to be the trapping of the beam by the unstable plasma wave. The amount of energy that can be converted into radiation from the electron beam can be theoretically estimated.

8741 Pulsation systems of irradiation intensity in lasers. Dement'ev, V.A.; Zubarev, T.N.; Oraevskii, A.N. *Tr. Fiz. Inst., Akad. Nauk SSSR;* 91: 3-74(1977). (In Russian).

A study is made of laser operational conditions in spiking behavior. A method is worked out for analyzing equations which describe processes in lasers and which constitutes a variation of the Fourier method in combination with the small parameter method as applied to a given specific problem. The method makes it possible to examine in a unified way stationary states of generators, their stability and transient processes. The following laser modes were analyzed: lasers on travelling and standing waves, with a localized active substance, with a non-uniform luminescence line, and in a resonator with quality dispersion. A study was made of the effect that unstable pumping and resonator parameters have on the conditions of laser generation. A stochastic study was made of a chaotic system of laser generation and a laser with noise pumping. The studied situations made it possible to formulate criteria of various spiking systems of generation by different types of lasers. An attempt was made to compare a few theoretical conclusions with available experimental data.

8742 Study of injection lasers. Part II. Bogatov, A.P.; Eliseev, P.G.; Sverdlov, B.N. *Tr. Fiz. Inst., Akad. Nauk SSSR;* 91: 75-115(1977). (In Russian).

Problems of the modal emission composition of injection lasers are discussed as well as methods of controlling lasers by selective resonators. Experimental results are cited for studies of a laser with an external dispersion resonator in which one or two reflective diffraction lattices are used. The phenomenon of asymmetric interaction of spectral modes is interpreted as the forced scattering of a laser's emission on dynamic heterogeneities of electron density in an active medium. An examination was made of the principle of isoperiodic substitution of atoms in multi-component solid solutions on whose basis new types of heterolasers were built in the infrared range and which function at room temperature.

8743 Active media, designs, and diagrams of powerful combination lasers. Grasyuk, A.Z.; Efimkov, V.F.; Zubarev, I.G.; Kotov, A.V.; Smirnov, V.G. *Tr. Fiz. Inst., Akad. Nauk SSSR;* 91: 116-146(1977). (In Russian).

Substantiation is offered for using liquid nitrogen and liquid oxygen as active media for powerful combination lasers (forced combination dispersion lasers). Test results are presented for studies of non-linear light losses which cause a decrease in the transparency of liquid oxygen and liquid nitrogen. Methods are presented for reducing non-linear losses: filtration systems, creation of excess pressure, etc. A description is given of cryogenic cuvettes for liquid nitrogen and oxygen in which the active media have a high degree of spatial uniformity of pumping emission along the length of up to 1 meter. A description is given of systems which provide high spatial uniformity in pumping emission along the length of the active medium: focusing prismatic array in combination with quadratic sectional light guide. Various practical diagrams are presented illustrating impulse combination lasers.

8744 Limiting resonance characteristics in capacity of ring gas lasers. Alekseev, V.A.; Yatsenko, L.P. *Tr. Fiz. Inst., Akad. Nauk SSSR;* **91**: 147-158(1977). (In Russian).

An examination is made of the limiting attainable widths and contrast power resonances in ring gas lasers. The width of the resonances was shown to depend not only on the gas concentration of the absorption medium but also on macroscopic parameters—the bond coefficients of travelling waves through reverse reflection, generation intensity and quality factor of the resonator. A non-linear relationship was found between the width of the resonances and gas density in the absorption cell.

8745 Kinetics of thermal ionization and recombination. Plasma lasers in a molecular medium. Biryukov, A.S.; Reshetnyak, S.A.; Shelepin, L.A. *Zh. Prikl. Spektrosk.;* **27**: No. 5, 796-803(1977). (In Russian).

A mechanism is proposed for the thermal ionization of molecular gas and the dissociative recombination of plasma. Both of these phenomena are described by the evolution of a dynamic molecule—atom system and constitute a unified ionization-chemical process. Corresponding kinetic equations are recorded for an oxygen plasma which were solved for the quasi-stationary stage of recombination. Discussed on this basis are the conditions for the emergence of population inversion on molecular and atomic transitions.

8746 Conversion of CO_2 laser's emission frequency into the visible region when combining with the emission of a dye laser in cesium vapor. Popov, A.K.; Timofeev, V.P. *Zh. Prikl. Spektrosk.;* **27**: No. 5, 804-808(1977). (In Russian).

An arrangement is proposed for the effective parametric conversion of a CO_2 laser's emission frequency into the blue region with lambda = 460 nm in cesium vapors. The simultaneous restructuring of the emission frequency of the dye laser pumping within the doublet $6p^2P^0$/sub $1/2, 3/2$/ and the total frequency near the doublet 7 p^2P^0/sub $1/2, 3/2$/ is suggested in order to achieve wave synchronism. Yields from dual-photon resonance at a magnitude of the order of 100 cm^{-1} are considered advisable in this case. A conversion factor in the order of 1100% was shown to be possible when pumping power was several kilowatts.

8747 Study of time and energy characteristics of impulse atomic gas lasers in magnetic field. Voitovich, A.P.; Dubovich, M.V. *Zh. Prikl. Spektrosk.;* **27**: No. 5, 809-815(1977). (In Russian).

A study was made of time and energy characteristics of impulse lasers in atomic neon, carbon and nitrogen with an active medium in a magnetic field and with isotropic and anisotropic resonators. A study was made of the effect of a magnetic field on the energy characteristics of generation in transitions whose levels have identical and different Lande g factor multiples. The generation output was shown to decrease with a rise in H when g_1 not equal to g_2 as a result of a decrease in the non-saturation coefficient of amplification for waves with circular polarizations. The time characteristics of lasers were found to depend on the magnetic field because of changes in the concentration and energy of electrons along the cross-section of the gas-discharge tube. The correlation between the type of the emitting dipole and the polarization of the emission being generated was found to influence the flare-up time of generation.

8748 Thermal effect in a He—Ne laser during exposure to penetrating radiation. Ter-Pogosyan, A.S.; Baloshin, Yu.A. *Zh. Prikl. Spektrosk.;* **27**: No. 5, 816-821(1977). (In Russian).

A theoretical study and design were made of the temperature system for a He—Ne laser caused by exposure to penetrating radiation in the absence of forced cooling. An examination was made of thermal regimens for the positive pole of gas discharge prior to exposure and during stationary irradiation with consideration given to thermal exchange phenomena on the external and internal wall surfaces of the laser tube. Results are given for calculations using these formulas for various output values of stationary irradiation and various coefficients for the transformation of the sources of electrical power into heat.

8749 Distortion of a ring laser's frequency characteristics as effected by two simusoidal signals. Kutsak, A.A.; Kruglik, G.S. *Zh. Prikl. Spektrosk.;* **27**: No. 5, 822-825(1977). (In Russian).

A solution was found to a phase equation for a ring laser which accounts for the modulation of "substitution" by two sinusoidal signals, based on the method of averages. The frequency characteristics were shown to have two regions of parametric resonance which are "pushed apart" when approaching the excitation frequency Ω_1 and Ω_2. The beat frequency in the region between the resonances shifts both toward Ω_1 and Ω_2, in which case the resulting shift depends on the correlationship between the amplitudes of external signals and the frequency difference of the "substitution" relative to their average frequency Ω. If $\Omega_2 - \Omega_1$ is less than the width of each of the "trays" the forced synchronization then takes place near Ω, and when the region of synchronization is approached there occurs not only a "tightening" of the beat frequency towards Ω, but also its "repulsion," proportional to $\Omega_2 - \Omega_1$ or $(\Omega_1 - \Omega_2)^2$.

8750 Study of changes in the isotopic composition of neon in the active cells of helium—neon lasers during prolonged continuous discharge. Dovgii, Ya.O.; Bilyi, Ya.M.; Koltun, V.L.; Samberskii, V.A.; Senyukov, A.I. *Zh. Prikl. Spektrosk.;* **27**: No. 5, 913-915(1977). (In Russian).

Measurements were made of the isotopic composition of neon in sealed off Ne—He tubes of ring lasers during prolonged continuous discharge (up to 2500 hrs). Fluctuations were found in the isotopic composition of neon which are primarily associated with fluctuations in the discharge current. A proposed hypothesis was experimentally tested and qualitatively confirmed. The fluctuations were shown to bear a statistical character and the isotopic composition of neon of the sealed off cell remains practically constant during prolonged discharge. A stabilized discharge supply at small discharge currents should be used in order to stabilize the irradiation of isotopic components having a balanced ^{20}Ne and ^{22}Ne mixture.

8751 Investigation of pulse gas-discharge lasers utilizing atomic transitions. Isaev, A.A.; Petrash, G.G. *Proc. (Tr.) P.N. Lebedev Phys. Inst. (USSR) (Engl. Transl.);* **81**: 1-87(1976).

An investigation was made of pulse gas-discharge lasers utilizing transitions from resonance to metastable levels in helium, thallium, and lead atoms and in mercury ions. All of these lasers had high ultimate efficiencies. The population inversion mechanism of the green thallium line emitted from thallium iodide vapor was studied. Investigations were made of the pulse laser emission and superradiance due to 2p-1s transitions in neon, argon, krypton, and xenon; the population inversion mechanism responsible for these transitions was confirmed. The experimental data obtained in the study and the results of other workers were used to analyze the prospects of pulse lasers of the type considered. The active media and transitions, which should ensure pulse stimulated emission, were identified.

8752 Pulse gas lasers utilizing electronic transitions in diatomic molecules. Kaslin, V.M.; Petrash, G.G. *Proc. (Tr.) P.N. Lebedev Phys. Inst. (USSR) (Engl. Transl.);* **81**: 89-186(1976).

A detailed experimental investigation was made of the most important laser systems utilizing electronic-vibrational-rotational transitions in diatomic molecules. A study was made of C^3PI/sub u/ - B^3PI/sub g/ (second positive band system) and B^3PI/sub g/ - A^3SIGMA^+/sub u/ (first positive system) transitions in the N_2 molecule, B_1SIGMA^+ - A^1PI transition (Angstrom band system) in the CO molecule, and $2ssigmaE^1SIGMA^+$/sub g/ - $2psigmaB^1SIGMA^+$/sub g/ transition in the H_2 molecule. It was found that all these systems shared a common population inversion mechanism. This mechanism involved the excitation of the active levels by direct electron impact from the ground state of the molecules. The distribution of the excitation and gain between the bands was governed by the Franck-Condon principle. The energy and time characteristics of stimulated emission from tubes of different diameters were governed uniquely by the ratio E/N of the electric field E in the discharge tube to the active gas density N. Cooling of the active substance in such lasers increased strongly their gain. This made it possible to obtain a record output power from the majority of the investigated laser systems, to observe superradiance, to detect inversion of the sequence of intensities in the molecular spectra, and to reveal 180 new stimulated emission lines.

HEAT TRANSFER AND FLUID FLOW

REFER ALSO TO CITATION(S) 7970, 8048, 8052, 8070, 8081, 8082, 8086, 8170, 8171, 8172, 8268, 8272, 8299

8753 Rarefied gas dynamics. Potter, J.L. (ed.). New York; American Institute of Aeronautics and Astronautics (1977). 667p. (CONF-760710—P1).

From 10. international symposium on rarefied gas dynamics; Aspen, CO, USA (18 Jul 1976).

A total of 108 papers are presented under the following headings: gas mixtures--isotope separation; internal flow; external flows; jets and clouds; shock waves; gas-surface interaction; kinetic theory; gas kinetics; ionized gases; atomic and molecular beams; condensation in expansions; condensation and evaporation; and instrumentation. Separate abstracts were prepared for nine papers; five of the remaining papers were previously abstrated. (DLC)

8754 (LA-tr—78-43) **Studies of the entrainmnt behavior in steady and transient two-phase annular flow.** Langner, H. (Technische Univ. Hannover (Germany, F.R.). Fakultaet fuer Maschinenwesen). 1978. Translation of German dissertation. 188p. Dep. NTIS, PC A09/MF A01.

Thesis.

Experimental and theoretical studies of the proportion of droplets in two-phase flow with high vapor content are discussed. This proportion of droplets is called the "entrainment." It is first the influence of various hydrodynamic and thermodynamic parameters on the entrainment behavior of steady, heated two-phase flows which is studied, and here, for reasons of simpler and cost-saving experimental technique, the experiments are carried out with the model fluid R12 (CF_2Cl_2-difluorodichloromethane). It can be established that the flow vapor content and the total mass flux are the decisive influencing parameters on the entrainment mass flow in the vapor core of the flow. The system pressure and the heat transfer surface load are only of subordinate significance with respect to the quantity of entrainment. Finally, the experimental studies were expanded to transient flow, and here, in addition, the influence of the acceleration on the transient behavior and on the entrainment of droplets was studied. In addition to these measurements, based on the fundamental conservation theorems for mass, energy, and momentum, a theoretical calculation procedure for calculation of the proportion of entrainment in two-phase flow was developed. This equation system permits the determination of the entrainment mass flow both in steady and quite transient flow. The comparison between measurement and calculation gives satisfactory agreement. In the second section of the theoretical part, similarity laws relative to the entrainment behavior between the model and the original fluid were worked out, which permit a transfer of the model experiments to original conditions in practice.

8755 Investigation of heat transfer and aerodynamic resistance of plate heat transfer surfaces with turbulizers in the form of hemispherical protrusions. Legkii, Yu.A.; Babenko, Yu.A.; Dikii, V.A. (Kiev Polytech Inst, Ukr SSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 12, 81-88(Dec 1977). (In Russian).

Plate heat transfer surfaces with stamped turbulizers in the form of hemispherical protrusions with different protrusion spacing and radius values are investigated. Relations are obtained for mean heat transfer and aerodynamic resistance. A comparison of heat characteristics shows that the most effective surfaces with a staggered layout of protrusions and the spacing ratio of $S_1/S_2=0.67$ to 1.5 are the most effective. They are 75% more effective than smooth pipe surfaces.

8756 Calculation of the critical discharge in one-dimensional two-phase flow. Ravoskii, I.S.; Dryndrozhik, E.I. (Moscow Eng-Phys Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Energ.;* No. 12, 116-118(Dec 1977). (In Russian).

A method of determination of the critical flowrate of a vapor/liquid stream is described. This method is based on the calculation of the velocity of sound in a vapor/drop stream by the frequency of the first harmonic taking into account relaxation processes. Calculated results are compared with experimental data showing a good agreement between them (deviation does not exceed 3%).

8757 Film thickness in gas-liquid two-phase flow. I. Effect of orifice inserted into tube. Sekoguchi, K.; Fukano, T. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Kawakami, Y.; Shimizu, H. *Nippon Kikai Gakkai Rombunshu;* **43**: No. 373, 3417-3426(Sep 1977). (In Japanese).

The effect of an obstacle inserted into a vertical circular tube on the liquid film thickness was studied in gas-liquid two-phase flow. An orifice was inserted into a tube. The flow rate was controlled, and the thickness of water film was measured by Fukano's constant electric current method. The time variation of hold-up can be measured, and the thickness was deduced from the hold-up. The effect of the orifice on the film thickness was serious. The minimum thickness just under the orifice was thinner than that in case of no orifice. The reason is that the supply of water is cut off, and the film under the obstacle becomes thin rapidly. This is called drainage. The film thickness of upstream of the orifice was less than 0.1 mm when the gas flow speed was 1 to 5 m/s. The frequency of production of film was high in case of thin film. The film thickness of downstream of the orifice was thinner for faster gas flow speed, and the thickness reaches to the same as the minimum thickness of upstream. The thickness near the orifice was thinner than that far from the orifice.

8758 Film thickness in gas-liquid two-phase flow. II. Effect of four-rectangular-obstacles inserted into tube. SEkoguchi, K.; Fukano, T. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Kawakami, Y.; Shimizu, H. *Nippon Kikai Gakkai Rombunshu;* **43**: No. 373, 3427-3434(Sep 1977). (In Japanese).

The effect of four rectangular obstacles inserted into a circular tube has been studied in gas-liquid two-phase flow. The obstacles are set on the inner wall of the tube, and the ratio of the opening is 0.6. The water film flows partially through the obstacles. The minimum thickness of water film was measured in relation to flow speed. The serious effect of the obstacles was seen against the formation of water film, and drainage under the obstacles and backward flow play important roles. Since water film can flow partially through the obstacles, the film in case of the rectangular obstacles in thicker than that in case of an orifice when the gas flow speed was slower than 5 m/s. However, when the gas flow speed is over 5 m/s, the film thickness was thinner. The minimum film thickness of downstream of the obstacles was almost same as that in case of no obstacle. The minimum film thickness of up stream depends on the location of measurement due to the effect of drainage.

8759 Flow of gas mixtures with vibrational energy relaxation in plane and axisymmetric nozzles. Breev, V.V.; Minin, S.N.; Pirumov, U.G.; Shevchenko, V.R. *Fluid Dyn. (USSR) (Engl. Transl.);* **12**: No. 5, 743-749(Sep-Oct 1977).

A method is described for the calculation of plane and axisymmetric flows of gas mixtures with vibrational energy relaxation in the subsonic, transonic, and supersonic regions of the nozzle. The method is based on numerical solution of the inverse problem of nozzle theory. Results are given for the flow of a CO_2-N_2-H_2O-He mixture with vibrational relaxation and compared with the results of one-dimensional calculations. It is found that vibrational-energy relaxation has a significant effect on the gasdynamic parameters of flow in nozzles with large relative expansion and therefore in choosing a nozzle shape, especially in the supersonic region, it is necessary to calculate the nonequilibrium flow. It is shown that the geometry of the transonic and supersonic regions of the nozzle has a considerable effect on the distribution of the inverse population of the level and the amplification factor.

8760 Pressure drop in channels with boiling and flow parallel to rod bundles. Tolubinskii, V.I.; Vasil'ev, A.A.; Stoyanova, N.A. (Ukr Acad of Sci, Eng Thermophys Inst, Ukr SSR). *Heat Transfer - Sov. Res.;* **9**: No. 3, 15-19(May-Jun 1977).

Axial flow along rod bundles is extensively used in heat exchangers. The pressure drop in channels with such rod bundles, operating with forced convection of boiling heat-transfer agents, is generally calculated by methods developed earlier for pipes and annuli. A technique for data reduction and for calculating the pressure drop in channels with boiling is proposed. This technique was checked out experimentally in the case of upward forced flow of boiling water parallel to a heated rod bundle. 2 refs.

8761 Calculation of unsteady heat transfer in elliptical section tube on laminar flow of incompressible liquid. Belyaev, N.M.; Kochubei, A.A.; Ryadno, A.A. (Dnepropetrovskij Gosudarstvennyj Univ. (Ukrainian SSR)). *Teplofiz. Vys. Temp.;* **15**: No. 2, 341-346(1977). (In Russian).

An analytical expression for evaluating the distribution of non-stationary temperatures in a laminar flow of an incompressible liquid in a tube with elliptical cross section has been obtained as a result of joint application of the Kantorovich method and the characteristic technique. The solution of the problem of finding non-stationary liquid temperature field is reduced to the solution of the energy equation with boundary conditions of the first kind. A comparison with conventional techniques confirms the validity of the method offered in the whole range of parameter variations.

8762 Thermal laminar liquid convection in an annular space under given heat flux. Braylovskaya, V.A.; Petrazhitskii, G.B. *Zh. Prikl. Mekh. Tekh. Fiz.;* No. 3, 109-114(1977). (In Russian).

A non-stationary process is considered for incompressible liquid flow and heat exchange in a horizontal annular channel at the isothermal interior boundary and continuous heat flux on the exterior. The investigation is carried out on the basis of numerical solution of the system of two-dimensional non-stationary equations of motion, continuity and energy. The heat exchange stationary performance boundary at convection motion is approximated by the formula Fo = 1,52/Rasup(0,12), where Fo and Ra - are Fourier and Rayleigh numbers, respectively. At the stationary performance the diagram of convection coefficient Esub(k) dependence on Rayleigh criterion approximated by formula Esub(k) = 0,257 Rasup(0,21). It is found that at small Ra(Ra < 2300) the heat exchange is more intensive under the condition of heat flux constancy on the exterior wall, while at large Ra - in case interior wall being isothermal.

8763 Calculation of composition and thermodynamic properties of dissociating gases by the initial atom method. Mika, V.I.; Semenov, A.M. (Moskovskij Ehnergeticheskij Inst. (USSR)). *Teplofiz. Vys. Temp.;* **15**: No. 2, 268-276(1977). (In Russian).

Application of the initial atom method for calculating thermodynamic properties of arbitrary non-ideal dissociating gases using group resolutions of thermodynamic functions has been considered. A method for asymptotic evaluation of the composition of reacting mix has been suggested within the framework of the initial atom method. The theoretical results of composition and thermodynamic properties of dissociating water vapor at 10^{-3} (<=) p (<=) 10^2 MPa and 10^3 (<=)) T(<=) 10^4 K obtained by the method considered are given.

8764 Analytical study on heat and mass transfer processes in laminar flow of chemically nonequilibrium mixture $2NO_2$ reversible $2NO + O_2$ in a flat channel with a constant temperature of an inert impermeable surface. Mishina, L.V.; Nesterenko, V.B.; Serebryanyi, G.Z.; Tverkovkin, B.E. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 2, 68-75(1977). (In Russian).

A set of linearied differential equations in partial derivatives describing heat and mass transfer in hydrodynamically stabilized laminar flow of the chemically nonequilibrium mixture $2NO_2$ reversible $2NO + O_2$ under consideration has been solved by the Fourier method. Analytical expressions for a composition, a bulk temperature and Nu number have been obtained. An effect of system parameters on characteristics of heat and mass transfer of chemically nonequilibrium mixture has been studied. An expression for the theoretically stabilized Nu number of the chemically nonequilibrium mixture has been obtained.

8765 Application of a zonal calculation method in analytical investigation of heat and mass transfer characteristics of chemically nonequilibrium mixture $2NO_2$ reversible $2NO + O_2$in laminar flow in a flat channel. Mishina, L.V.; Nesterenko, V.B.; Serebryanyi,, G.Z.; Tverkovkin, B.E. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 2, 76-83(1977). (In Russian).

A method of accounting for the dependence of a generalized parameter of heat and mass transfer problem on temperature in calculations of characteristics of heat and mass transfer of the chemically nonequilibrium mixture in laminar flow in a flat channel with Tsub(wall) = const is proposed. A comparison of analytical results and numerical ones obtained from the solution of a set of nonlinear differential equations describing heat and mass transfer in the mixture being formed on dissociation of nitrogen oxide is made. It is shown that by using analytical expressions obtained in solving a linearized set of equations and applying the proposed method the calculation of heat and mass transfer characteristics can be performed with a sufficient accuracy.

8766 Solution of a conjugate problem of steady heat transfer by the structural method. Rvachev, V.L.; Slesarenko, A.P.; Popivshchii, V.I. (AN Ukrainskoj SSR, Kharkov. Inst. Problem Mashinostroeniya). *Teplofiz. Vys. Temp.;* **15**: No. 2, 337-340(1977). (In Russian).

A solution of convective laminar heat exchange problem as applied to round and square tube with heat being evolved in an inner round rod in given. The use of the structural method makes it possible to build a system of coordinate functions precisely conforming to boundary and conjugation conditions (conditions of the fourth kind) across the contact surface of different media (liquid - rod).

8767 Experimental study on mass transfer in steam generating channels with porous deposits. Styrikovich, M.A.; Martynova, O.I.; Miropol'skii, Z.L.; Polonskii, V.S.; Bezrukov, E.K.; Kurmaz, V.F. (Moskovskij Ehnergeticheskij Inst. (USSR)). *Teplofiz. Vys. Temp.;* **15**: No. 2, 353-358(1977). (In Russian).

An experimental investigation of the effect of loose iron oxide deposits on the surface of a steam generating tube on the concentration extent of truly dissolved impurities in the near-wall heat transfer layer has been carried out. The investigation was made in the ranges of cycle parameters: pressure, 9.8 to 16,7 MPa; mass velosity, 1000 to 3500 $kg/m^2.s$; heat load, and 0.58 to 1.16 MW/m^2. The comparison with the experimental results on a clean surface has shown an increase in impurity concentration by 3 to 5 times in the whole parameter range studied.

8768 Effect of small additions of NO on achievable overheating of N_2O_4. Vinogradov, V.E.; Sinitsyn, E.N.; Skripov, V.P. (AN SSSR, Sverdlovsk. Ural'skij Filial). *Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk;* No. 2, 58-62(1977). (In Russian).

Kinetics of boiling of overheated solutions of nitrogen oxide in nitrogen tetroxide with the NO weight concentrations of 1.8%; 2.7%; 4.6% has been investigated in a clean bubble chamber. The procedure of measurement of a mean life time tau(T)sub(p) of the overheated liquid under quasistatic conditions has been used. The temperature dependences of tau(T)sub(p) according to the isobars of 2.9; 9.8; 20.0 and 39.2 bar have been obtained. A proportional decrease of the achievable overheating temperature of the solution with an increase of NO concentration has been found out. For a solution with the 2.7% concentration of nitrogen oxide tests have been performed on the induced boiling up under gamma radiation effect at pressures of 2.9; 9.8 and 20.0 bar. Radiation appreciably decreases tau near the boundary of spontaneous boiling up. No anomalies in the behaviour of overheated solution as compared to clean nitrogen tetroxide have been observed.

8769 Volumetric heat transfer coefficient of steam condensation in direct-flow dynamic two-phase bed. Khoze, A.N.; Zakharov, A.S. (Novosibirsk Electrotech Inst, USSR). *Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk;* No. 8/2, 30-33(1977). (In Russian).

Hydrodynamics and heat and mass transfer during steam condensation in a through-flowing dynamic two-phase bed are considered. Theoretical relations are obtained for determining gas content and resistance of the dynamic bed. The main factors having an effect on the intensity of the process of condensation are established. A relation is given for the dependence of the mean volumetric heat transfer coefficient on the influencing factors.

8770 Transport processes in boiling and two-phase systems including near-critical fluids. Hsu, Y.Y.; Graham, R.W. Washington, DC; Hemisphere Publishing Corp. (1976). 559p. $30.00.

Concise views of current theories on boiling, two-phase flow, and supercritical heat transfer are presented, and the similarities and dissimilarities in the mechanisms of these two modes of heat transfer are examined. Information is included on boiling mechanisms; two-phase flow dynamics, heat transfer, flow parameters and equations, burnout, and measuring equipment; and the properties and heat transfer characteristics of near-critical fluids. (LCL)

MATERIALS TESTING

REFER ALSO TO CITATION(S) 8079, 8604

8771 (BNWL-SA—6443(Rev.)) **Automatic cartridge case inspection and process control monitor.** Coleman, W.J.; Swinth, K.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1976. Contract EY-76-C-06-1830. 17p. Dep. NTIS, PC A02/MF A01.

Portions of document are illegible.

Battelle, Pacific Northwest Laboratories has developed an advanced cartridge case measurement/eject systems (CCMES) which automatically inspects and rejects cases at up to 1200 per minute. The system consists of a mechanical handler, measurement instruments, and a dedicated computer. System operation is monitored and controlled while the product is being measured. Five case dimensions are measured by an electro-optical system using diode arrays to measure a case image at unity magnification. By scan averaging, measurement standard deviations as small as 2.5 microns are obtained at a throughput of 1200 cases per minute. Measurements made with the system fall within the uncertainties of hand-gauged values for the same cases. Four zones on each case are examined for surface flaws, such as dents and scratches, by detecting light scattered from the surface. The system can detect these surface flaws at inspection rates of 1200 cases per minute. Using electro-optic methods, two additional measuring stations detect vent hole presence and gross size deviations to prevent mechanical jams. A third station employs an eddy current technique to detect splits and folds in critical regions of the cartridge. The overall system has passed quality assurance tests administered by the sponsor and will soon be installed at the Lake City Army Ammunition Plant.

8772 (ORNL/TM—6456) **Ultrasonic flaw detection and characterization in structural materials by spectral analysis.** Adler, L.; Cook, K.V.; Simpson, W.A.; Lewis, D.K.; Fitting, D.W. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 27p. AT.

A method of quantitatively determining size and location of simulated flaws in anisotropic materials such as stainless steel welds is described. Previous work demonstrated that spectral analysis of a broad-band ultrasonic pulse scattered from a defect can be used to determine its size and orientation in isotropic materials if the velocity of sound in the material is known. In an anisotropic structural material—stainless steel weld, centrifugally cast pipe—the velocity of sound—both shear and longitudinal—depends on the sound's direction. When anisotropy is not taken into account, defect location and size are frequently misjudged. The effect of this structural variation in materials must be considered to obtain the correct size and location of defects by frequency analysis. A theoretical calculation, including anisotropy, of the scattered field from defects is also presented.

8773 Managing corrosion control. Passell, T.O. *EPRI J.;* **3**: No. 7, 14-19(Sep 1978).

Members of the Electric Power Research Institute's (EPRI) Corrosion Advisory Committee (CAC) are looking for ways to resolve problems caused by the localized corrosion of components and subsequent power outages, preventive inspections, and repairs. Focusing on practical operating problems with high-consequence effects, the CAC reviews and recommends research and testing methods. The CAC was organized in 1975 with a broad-based group of key technical people serving three-year terms. The initial work has emphasized nuclear plants, whose outages are more costly. The committee allows quick communication throughout the industry and combines expert advice from a diversity of disciplines. The author summarizes topics already considered by the CAC and outlines plans for the future.

8774 Radiographic camera with internal mask. Barrett, H.H. (to Raytheon Co.). US Patent 4,092,540. 30 May 1978. Filed date 26 Oct 1976. 10p.

The invention discloses a radiographic camera having a scintillator and an array of photodetectors positioned for viewing a common region of the scintillator, and wherein a mask system is interposed between the scintillator and the array of photodetectors for increasing the resolution of an image produced by the camera. The mask system has a pair of mask plates which are spaced apart and have similar formats of opaque materials thereon. The mask system provides a more rapid variation in the intensity of light received at a photodetector as a function of locations of scintillations on the scintillator. A reference signal source providing a signal pattern in accordance with the intensity variation is utilized for decoding shadows cast by the mask to produce the image.

8775 Scrutiny of precision for measurement of height and depth of crack by radiographic examination. Applied ^{192}Ir gamma-ray source to steel plate, 25 mm in thickness. Hirano, K.; Hayashida, T.; Higashi, T. (Toa Hihakai Kensa Kabushiki Kaisha, Kitakyushu, Fukuoka (Japan). Sone Lab.). *Hihakai Kensa;* **27**: No. 1, 11-17(Jan 1978). (In Japanese).

Theoretically, several methods for using stereo radiographic techniques proved that measuring the dimension of defects are effective. In this experiment, precisions in instances where two simple geometric methods to measure the height of cracks and the two markers method to measure the depth of cracks were applied and evaluated. Experimental results obtained are as follows: (1) those methods to measure the crack height need to be considered supplementary methods, because those measuring precisions were lower for reasons of disregarding enlargement of images in the mathematical expression, and (2) this method of measuring the crack depth is useful, because those experimental measuring values were nearly equal to the real ones.

8776 Study on detection method of cross section size of planar defects and on effect of focus size for the detectability. Kanno, A.; Sakaki, M.; Katsumata, K. (Ship Research Inst., Tokyo (Japan)). *Hihakai Kensa;* **27**: No. 1, 26-34(Jan 1978). (In Japanese).

Considering the requirement for the measurement of defect size in a plate thickness direction, this paper presents a detection method of cross section size of defects, applying a drawing figure method with three radiographs, which were radiographed by three different x-ray directions. This method showed about a 20 percent less value. This paper also investigated the relation between the wire diameter and the cross section area of planar defect at the condition of discernible limit. To study the effect of x-ray focus size on the detectability of planar defects, in-motion radiography was adopted to change the effective focus size. As result, the high energy radiograph had a tendency to be influenced by the focus size, that is geometrical unsharpness, more than the low energy radiograph. It was considered to be more reasonable that the allowable geometrical unsharpness is set to a constant value rather than to values increasing with the thickness.

8777 Experimental studies on the detectability of cracking defect in the weld part by the high energy x-ray apparatuses, betatron and linear accelerator, and on the measuring method of the crack height. Morikawa, Y.; Koyama, K.; Nakatsuka, K. (Kensa-Kenkyu-Sho K.K., Yokohama (Japan)). *Hihakai Kensa;* **27**: No. 1, 35-40(Jan 1978). (In Japanese).

In the radiographic testing of weld parts, the detectability of crack changes according to the apparatus applied. The crack detectability in relatively thick steel plate (60mm and 100mm) and the measuring method of the height of defect by the double exposure method were studied. The apparatuses were betatrons and linear accelerators. The results were as follows: (1) for the slit-type cracking defect in thick steel plate (thickness 100mm), the detectability by the linear accelerator was a little better than that by the betatron, (2) for the natural cracking defect in thick steel plates (thickness 100mm), the detectability by both apparatuses was nearly same, and (3) for the measurement to the height of defect in thick steel plate (thickness 60mm), the double exposure method shows about a 4% error.

8778 Estimation of x-ray defectoscopy parameters of electroluminescent memory screens. Kudryavtseva, M.V.; Lipin, A.L.; Pekerman, F.M. (Gosudarstvennyj Inst. Prikladnoj Khimii, Leningrad (USSR)). *Defektoskopiya;* No. 4, 49-52(1977). (In Russian).

The principal parameters of memory electroluminescent screens were evaluated, making it possible to use them as x-radiation detectors for x-ray flow detection purposes. The following parameters are considered: sensitivity threshold, dependence of luminosity intensity on irradiation rate at various voltages on the x-ray tube. It is shown that the use of the memory screen for x-ray flaw detection purposes is promising when the material density permits the voltage on the tube to be within 70 to 150 kV. The material thickness accessible for inspection with the use of the memory screen is controlled by its sensitivity threshold starting with which the accumulation and remembering of the information entered onto the screen become possible.

8779 Automatic processing of radiometric data. Pokrovskii, A.V. (Nauchno-Issledovatel'skij Inst. Ehlektronnoj Introskopii, Tomsk (USSR)). *Defektoskopiya;* No. 4, 40-49(1977). (In Russian).

Consideration is given to the problems of radiometric information automated handling and decision making on the state of the controllable object at the model and algorithm levels. This is realized by systematization of the practical problems of radiation monitoring and their study based on the theory of statistical solutions. The results of modelling and experimental evaluation of the efficiency of the algorithms developed are presented. The following three functional modes of a radiometric system have been studied, namely, measurement, monitoring, and detection.

8780 Equipment adjustment in ultrasonic weld inspection. Deutsch, V. (Deutsch (K.), Wuppertal (Germany, F.R.)); Vogt, M. (Deutsch (K.), Wuppertal (Germany, F.R.)). *Werkstattstechnik;* **67**: No. 6, 327-334(1977). (In German).

The guidline for weld inspection of the German Association for Nondestructive Testing permits two possibilities of adjustment. For the so-called AVG method, one starts from diagrams depending on the testprobe, where transfer to the workpiece depends on keeping within certain conditions. By contrast, the other method of adjustment is by a cylindrical hole transverse to the ultrasonic rays on the workpiece. A comparison of the necessary stages of adjustment shows the superiority of the test error process.

SAFETY ENGINEERING

REFER ALSO TO CITATION(S) 8669

8781 Organization and activity of the fire research station. Cardillo, P. (Stn Sper per i Combust, San Donato Milanese, Italy). *Riv. Combust.;* **31**: No. 11-12, 387-390(Nov-Dec 1978). (In Italian).

A survey is made of the work carried out by the British Fire Research Station at Borehamwood near London, on accidental combustion and the prevention of fires and explosions. This work deals with the behavior of materials and structures during fires, the movement of smoke and its control, the behavior and propagation of fires, smoke and toxic products, the detection and extinction of fires, and protection against explosions. 20 refs.

8782 Design, use and operation of blow-down systems as a safety installation for chemical plants. Pilz, V. (Bayer A.G., Leverkusen (Germany, F.R.). Bereich Angewandte Physik). *Ger. Chem. Eng. (Engl. Transl.);* **1**: No. 2, 63-73(Jun 1978).

In the present paper an attempt is made to illustrate the design and operation of blow-down systems, and various possibilities for relief of two-phase (gas/liquid) systems are outlined. The effect of additional heat input or output during the operation is investigated, in addition to blow-down in the case of a chemical reaction getting out of control. Some of the calculated results are compared with actual measurements from the blow-down test of a large chemical plant. In a final analysis, blow-down systems are considered in relation to other safety installations, and further problems as well as possible application strategies are discussed.

ELECTRONIC CIRCUITS AND DEVICES

REFER ALSO TO CITATION(S) 8196

8783 (BDX—613-1948(Rev.)) **Electrochemical machining deep through holes in 304 stainless steel. Final report.** Gillespie, L.K. (Bendix Corp., Kansas City, MO (USA)). Aug 1978. Contract EY-76-C-04-0613. 24p. Dep. NTIS, PC A02/MF A01.

Housings for electromechanical switches often require deep noncircular shapes in hard-to-machine materials. In a study to determine if electrochemical machining (ECM) could increase production, it was found that ECM was twice as fast as conventional broaching. ECM was able to maintain tolerances of +-152 μm (0.006 in.) on surfaces and +-304 μm (0.012 in.) on fillet radii. These are three times and six times respectively less consistent than conventional broaching.

8784 (BDX—613-1952(Rev.)) **Reliabiliity of packaged beam-lead transistors built with different pre-seal assembly techniques.** Gracey, J.P. (Bendix Corp., Kansas City, MO (USA)). Oct 1978. Contract EY-76-C-04-0613. 36p. Dep. NTIS, PC A03/MF A01.

The reliability of two TO-18 packaged beam-lead transistors was studied using high temperature reverse bias and high temperature storage as accelerated aging methods. Three pre-seal assembly

techniques were evaluated and compared based on reliability test results. Results were affected by the use of damaging breakdown voltage tests during part of the experiments.

8785 (BDX—613-2060(Rev.)) **Development of a comparative analyzer for microprocessor.** Rolfe, E.J. (Bendix Corp., Kansas City, MO (USA)). Oct 1978. Contract EY-76-C-04-0613. 20p. Dep. NTIS, PC A02/MF A01.

A new method of troubleshooting a microprocessor-based product using a reference unit comparison technique has been developed. This use of a comparative analyzer has significant advantages over conventional digital troubleshooting techniques. The basic concept of this analyzer is readily adaptable to a variety of microprocessor applications.

8786 (SAND—78-0801) **Transfer molding of flat flexible cable terminations.** Voida, G. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 37p. Dep. NTIS, PC A03/MF A01.

The terminations of cables are normally sealed with either liquid epoxy or polyurethane encapsulating resins. The use of two different transfer molded powdered epoxy compounds for sealing of flat, flexible cables which were laminated with acrylate adhesive is described. One of the molding compounds was mineral-filled and the other was glass fiber filled. Transfer molding was successfully employed without impairment to the thin polyimide cable strip, to the soldered connections, or to the plastic molded rack and panel type connectors. Cables potted with polyurethane potting resin were used as controls. The molding process and test results are reported.

8787 (SAND—78-1762C) **Additional data on realistic values for printed board conductor spacings.** Jennings, C.W. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract W-7405-ENG-36. 28p. (CONF-780951—1). Dep. NTIS, PC A03/MF A01.

From Institute of printed circuits; San Diego, CA, USA (18 Sep 1978).

Portions of document are illegible.

Printed boards with IPC Multi-Purpose Test Pattern B-25 were tested for breakdown voltage. The boards were procured from six suppliers each of which had some difference in fabrication process. Conductor separations which varied with board source were measured along with breakdown voltage. Measured data indicate that in most normal board environments, the minimum conductor clearances recommended by the IPC and other groups are very conservative and should be changed. A modification of the B-25 test pattern is proposed for use in data collection to provide the basis for reducing conductor clearances.

8788 **High performance avalanche transistor switchout for external pulse selection at 1.06 μm.** Davis, S.J.; Murray, J.E.; Downs, D.C.; Lowdermilk, W.H. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). *Appl. Opt.;* **17**: No. 19, 3184-3186(1 Oct 1978).

The design and performance of an avalanche transistor switchout are described. The device selects a single pulse from a train of cw or Q-switched mode-locked pulses and introduces less than +- 1% amplitude variation in the selected pulse. The prepulse rejection ratio exceeds 10^7, and a lifetime of greater than 10^7 shots has been achieved.

8789 **Range of standardized switchgear for worldwide application.** Kirstein, H.; Rose, B. (Siemens, Erlangen, Ger). *Siemens-Z.;* **52**: No. 4, 192-195(Apr 1978). (In German).

A modular system which enables low-voltage switchgear for almost any duty to be assembled from standardized parts is described. It is based on the main international standards and permits such switchgear to be assembled in factories both in the FRG and abroad. The 8PU standardized switchgear range makes it possible to solve problems of power distribution, switching duty and control with a high degree of reliability and economic efficiency, using withdrawable and non-withdrawable elements and fixed-mounted elements. The overall concept, which covers six panel types, is characterized by straightforward planning and manufacture and simple handling in spite of the large number of variants possible.

WASTE PROCESSING PLANTS AND EQUIPMENT

REFER ALSO TO CITATION(S) 8375, 8458, 8489, 8490, 8491, 8496

8790 **Refuse without flaw. Waste combustion including the processing of sewage sludge.** Koch, H. (Widmer und Ernst G.m.b.H. und Co. Anlagen K.G., Bad Hersfeld (Germany, F.R.)); Trebing, W. (Abfalltechnik G.m.b.H., Essen (Germany, F.R.)). *Energie;* **30**: No. 3, 94-97(Mar 1978). (In German).

The Ingolstadt waste incineration plant, which was taken into operation in 1978, is characterized by a sewage sludge treatment unit and waste heat utilisation. Layout, functioning, design and consumption data are described, as well as operational experience so far.

COMBUSTION SYSTEMS

REFER ALSO TO CITATION(S) 7309, 7419, 8414, 8483

8791 (TID—28868) **Fundamental characterization of alternate fuel effects in continuous combustion systems. Technical progress report No. 2, 15 November 1977—14 February 1978.** Blazowski, W.S. (Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.). 12 Jun 1978. Contract EC-77-C-03-1543. 6p. Dep. NTIS, PC A02/MF A01.

The research program is a multi-year effort to provide an improved fundamental understanding of the relationships between fuel properties and combustion characteristics and to develop analytical modeling/correlation capabilities for the prediction of fuel effects. The work will be limited to investigation of alternate liquid and gaseous fuels used in continuous combustion systems, with gas turbine systems receiving special attention. The program philosophy is to relate fundamental combustion phenomena to fuel characteristics using analytical models developed with and eventually verified by data obtained in carefully designed experiments. Effort during the first phase of this program will concentrate on key combustion properties and ranges of fuel variation of interest to subsequent efforts. Experimental work will include the utilization of unique ER and E experimental equipment for evaluation of fuel combustion characteristics. The analytical modeling effort will include new applications of quasi-global modeling techniques as well as predictions of and comparisons with the experimental results generated. During this quarter, a reliable procedure for jet-stirred reactor ignition was developed which does not involve hydrogen injection. Ethylene-air mixtures, with inlet temperatures as low as 25°C, were utilized. Analytical work during the past quarter concerned comparison of the existing quasi-global model for hydrocarbon combustion with available data and extension of the quasi-global modeling concept. Comparisons with existing data have shown that the present quasi-global model predicts well the ignition delay time for propane, but underestimates ignition delay times of ethane and butane.

8792 (TID—28869) **Fundamental characterization of alternate fuel effects in continuous combustion systems. Technical progress report No. 3, 15 February 1978—14 May 1978.** Blazowski, W.S. (Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.). 15 Jun 1978. Contract EC-77-C-03-1543. 17p. Dep. NTIS, PC A02/MF A01.

The research program is a multi-year effort to provide an improved fundamental understanding of the relationships between fuel properties and combustion characteristics and to develop analytical modeling/correlation capabilities for the prediction of fuel effects. The work is limited to an investigation of alternate liquid and gaseous fuels used in continuous combustion systems, with gas turbine systems receiving special attention. The program philosophy is to relate fundamental combustion phenomena to fuel characteristics using analytical models developed with and eventually verified by data obtained in carefully designed experiments. Consequently, the program will proceed along two parallel paths, modeling and experimental. A very active experimental program employing the Exxon jet-stirred combustor was conducted during the third quarter of this first year. Studies of the soot formation characteristics of ethylene and toluene were conducted and significant differences between these two hydrocarbons were found. Other hydrocarbon types were studied and a screening procedure was adopted to examine a large number of fuels. Finally, qualitative explanation of lean blowout and lean reactor operating characteristics were realized and the basis for quantitative evaluation of reactor surface effects and quasi-global kinetics under lean operating conditions was established. Activity during this period in developing an analytical model were at a reduced level and concentrated on comparison of the existing quasi-global model with available data, extension of the quasi-global model, and obtaining comparisons between calculated results and jet stirred combustor data.

8793 (TIS—5764) **Fluidized bed industrial boiler.** Anderson, J.B.; Norcross, W.R. (Combustion Engineering, Inc., Windsor, CT (USA)). 1978. Contract EX-76-C-01-2473. 10p. (CONF-780440—2). Dep. NTIS, PC A02/MF A01.

From American power conference; Chicago, IL, USA (Apr 1978).

Commercial size demonstration plants are required to confirm performance and operational capability. It is expected that the larger industrial steam generators with capacities of 50,000 pounds of steam

per hour and up will be in the size range that will most likely use coal. Therefore, the C-E development program is directed to a demonstration plant capable of supplying 50,000 lb/hr of steam in an environmentally acceptable manner. The goal of this C-E program is to demonstrate the potential of an atmospheric pressure, natural circulation, fluidized bed unit that satisfies the following requirements: Have the attributes of a "package" boiler--compact, shop assembled and rail shippable; create a minimal impact upon the industrial user--environmentally acceptable, economical and require minimum auxiliary equipment and space; operate in a manner consistent with present industrial practice; and fire coal competitively with other coal firing systems. This goal is being accomplished in a two-phase program. The first phase is a sub-scale, experimental program, of a fluidized bed demonstration unit. The construction and test operation of a demonstration unit constitutes the second phase. Although there has been considerable testing of laboratory size fluidized bed combustion units at atmospheric pressure, design criteria and correlations have not been developed sufficiently to permit design of a fluidized bed boiler on commercial basis with usual performance guarantees. The areas of uncertainty that require test data or development of equipment are included in the C-E development plan in order to support and confirm the design of the demonstration plant.

8794 Process for maximizing combustion of fuels. Leas, A.M. US Patent 4,091,614. 30 May 1978. Filed date 9 Sep 1976. 6p.

A process is described for maximizing combustion of fuels and maximizing thermal efficiency by cooling between or after combustors with heat recovery exchanges as steam generators or superheaters. Excess combustion air requirements are minimized by the utilization of metal oxides to provide oxygen by reaction with steam and producer gas.

8795 Emission reduction and increased energy from bark fired boilers. Klicius, R.K.; McCubbin, N. (International Environmental Consultants Ltd., Montreal). pp A101-A106 of 63rd annual meeting of the Technical Section, Canadian Pulp and Paper Association. Montreal; Canadian Pulp and Paper Association (1977).

From 63. meeting of the Technical Section, C.P.P.A.; Montreal, Canada (1 Feb 1977).

Reduction of particulate emissions from bark fired boilers is often possible by correcting the cause of particulate formation and carryover. A case study is presented to illustrate some common factors causing high particulate emissions due to boiler operation. The significance of these factors is discussed and recommended corrective actions are presented. This approach to emission control results in increased boiler efficiency and improved operations.

8796 Control of recovery furnace combustible emissions and SO_3 formation. Chamberlain, R.E.; Lofkrantz, J.E.; Norris, R.G.; Smith, A.R.; Wostradowski, R.A. (MacMillan Bloedel Ltd., North Vancouver, British Columbia). pp A233-A239 of 63rd annual meeting of the Technical Section, Canadian Pulp and Paper Association. Montreal; Canadian Pulp and Paper Association (1977).

From 63. meeting of the Technical Section, C.P.P.A.; Montreal, Canada (1 Feb 1977).

Combustion tests on a recovery furnace showed that the H_2S emission disappears before the CO emission. Holding the CO emission at approximately 250 ppM ensured a zero H_2S emission. Accordingly, CO metering is potentially an alternative means of monitoring furnace-generated H_2S. Stack monitoring is still required if direct contact evaporation is employed. Combined CO and H_2S monitoring would provide for control of furnace—generated H_2S through excess air, and direct contact evaporator—generated H_2S through liquor oxidation. Peak heat efficiency occurs when the minimum excess air is employed to achieve the required CO emission level. This coincides with a zero H_2S emission. Control by the flue gas oxygen level is not sufficiently accurate to achieve this optimum since a small error can lead to high combustible emissions, including H_2S, and in turn large efficiency losses. The required O_2 to achieve a low CO emission is a measure of the efficiency of recovery boiler design and its operation. This can vary between 2% and 6% O_2 depending upon whether the O_2 determination is on a wet or dry gas basis, the age of unit, and its operation. Moderate air supply modifications might provide for H_2S and heat efficiency performance of older furnaces equal to newer furnaces even under overload conditions. Minimum excess air firing contributes to increased heat efficiency, and reduced SO_3 formation. The latter could be important in control of fouling and corrosion in the furnace. These relationships have been well established by the power industry in the combustion of fuels containing sulfur. Application of CO measurement and control of a recovery furnace remains to be attempted.

UNDERGROUND ENGINEERING

REFER ALSO TO CITATION(S) 7285

MARINE ENGINEERING

REFER ALSO TO CITATION(S) 8603

8797 Structural response analysis of semi-submersible offshore structures in waves. Katayama, M.; Unoki, K.; Hatakenaka, K.; Ujihara, T. *Tech. Rev., Mitsubishi Heavy Ind.;* **15**: No. 2, 140-148(Jun 1978).

Recently, as semi-submersible offshore structures advance into deeper and rougher waters for operation, the design conditions have become more severe requiring structural response analysis in very high non-linear waves. From this viewpoint, an approximate response analysis method is presented for the semi-submersible offshore structures in waves based on the finite amplitude wave theory, and the results of a series of tank tests for verifying the accuracy in computation and its applicability to practical problems are included. Finally, the accuracy in computation and applicability of the computer program based on the finite and small amplitude wave theories are discussed by comparing with the results of the above tank tests.

8798 Pile response to dynamic lateral loading. Hwong, S.T.; Ghazzaly, O.I.; O'Neill, M.W. (Brown and Root, Inc, Houston, Tex). *Offshore Technol. Conf.;* **4**: 2255-2260(1978).

An approximate method is proposed for the analysis of a pile under low or high-amplitude dynamic lateral loading applied at the pile head. The soil-pile system is modeled by the vibrations of a beam on elastic half-space. The uncoupled spring factor (k) and damping coefficient (c) of the foundation medium are defined. Appropriate dynamic soil properties are introduced to determine k and c considering both geometric and material damping. The governing equation of motion of the pile is a fourth order, nonlinear, partial differential equation. Difference equation techniques with an iterative process were used in the solution of this equation for various boundary conditions. A computer program was developed for practical application of the proposed method. Comparison of computed results with those measured in instrumented, small-scale, pile tests in clay and sand is generally acceptable. 10 refs.

POLLUTION CONTROL EQUIPMENT

REFER ALSO TO CITATION(S) 8483, 8795, 8796, 8855

8799 Process for recovering sulfur by removal of sulfur dioxide from gaseous mixtures. Tung, S.E. US Patent 4,101,643. 18 Jul 1978. Filed date 30 Sep 1976. 18p.

The sulfur dioxide is first contacted in a scrubbing zone with a scrubbing agent which is an aqueous solution of an alkali metal sulfite. The pregnant scrubbing solution is then contacted with an organic transfer reactant which is a water-immiscible long chain aliphatic amine to effect a transfer reaction in which the amine combines with sulfite ions to form organic amine sulfite, and regenerate the alkali metal sulfite scrubbing agent. In the final step of the process, the long chain aliphatic amine sulfite is heated to decompose the sulfite, releasing sulfur dioxide and regenerating the amine. The regenerated amine, as well as the regenerated alkali metal sulfite scrubbing agent, are recycled in the process, and the sulfur dioxide product can be optionally further reduced to elemental sulfur.

8800 Process for the removal of sulfur oxides from gases. Poll, I. (to Shell Oil Co.). US Patent 4,101,641. 18 Jul 1978. Priority date 28 May 1976, Netherlands. 6p.

A process for the cyclic removal of sulfur oxides from gases in which the regeneration offgas containing sulfur oxides is partially combusted to produce a reducing gas and elemental sulfur.

8801 Process for the simultaneous removal of nitrogen and sulfur oxides from a gas stream. Ploeg, J.E.G. (to Shell Oil Co.). US Patent 4,101,634. 18 Jul 1978. Priority date 11 Feb 1976, Netherlands. 8p.

A process for the simultaneous removal of nitrogen oxides and sulfur oxides from a gas stream containing oxygen, in addition to nitrogen oxides and sulfur oxides, is disclosed.

8802 Method of filtering a sticky material-containing exhaust gas. Murayama, T.; Shimizu, S.; Miyakawa, T. (to Taisei Kensetsu Kabushiki Kaisha and Tokyo Gas Co., Ltd.). US Patent 4,097,251. 27 Jun 1978. Priority date 14 Apr 1976, Japan. 6p.

A method is described for treating a sticky material-containing exhaust gas to remove the sticky material therefrom, by introducing pulverized coal or coke having a particle size of 0.3 mm or less into the bottom of a hopper. The hopper is positioned below, and integrally connected with, a baghouse containing bag-filters, to form a protective layer of pulverized coal or coke having a thickness of at least 1 mm on the surface of each bag-filter, and then introducing the sticky material-containing exhaust gas into the hopper in a

manner such that the gas passes through the protective layer while the protective layer captures and retains the sticky material.

8803 Investigation of the influence of overlapping on the determination of the particle number. ter Kuile, T.; van der Wal, J.; Steenweg-van Witteloostuyn, H. (Nijverheidsorganisatie TNO, Delft (Netherlands). Forschungsinstitut fuer Umwelthygiene). *Staub-Reinhalt. Luft;* **38**: No. 6, 207-210(Jun 1978). (In German).

Knowledge of the particle concentration and the particle size distribution is requested for the design of dust separators. The results of the determination of these are influenced by the overlapping of particles, for example in ducts with high dust concentrations. The influence of the overlapping on the results of the microscopical determination of the numerical particle concentration of dust samples on membrane filters is investigated. - Laboratory experiments were carried out with monodisperse spherical particles. On the basis of the results of these experiments, a dust sampler was designed with which the particle size distribution in ducts can be determined. The advantage of this sampler is that the particle size distribution does not change during sampling.

8804 Filtering device for separating solids from a carrier gas. Fisher, E.; Olson, F.O. (to Fuller Co., Catasaugua, Pa. (USA)). German(FRG) Patent 2,345,408/C/. 7 Apr 1977. 8p. (In German).

The patent claim pertains to passable catwalks 'the effective width of which is considerably reduced during operation of the filter chambers by rotation about a horizontal axis'. In passable filter chambers of certain size - areas of 10 to 20 m^2, heights of 4 m or more - tube-shaped filter elements made of tissue are hanging in a large number above a tube sheet and are charged with polluted gas from a chamber bying below by means of a pipe nozzle each. For maintenance and exchange of used filter elements the tube sheet contains at least one narrow longitudinal passway and above, in more than man's height, a passable catwalk. The filter tube elements are periodically cleaned by shaking the upper support, i.e. emptied into the space below. As the tubes are placed as close together as possible, neighboring elements then are rubbing against this catwalk and are damaged. This is to be prevented by the protective design by rotating the catwalk about a longitudinal axis during filter operation, e.g. placing the walking surface in vertical position.

8805 Improved process to scrub recovery boiler flue gases. Katzen, R. (Raphael Katzen Associates International, Inc., Cincinnati); Button, E.F.; Haskell, B.W.; Pulliam, T.L.; Hokanson, A.E. pp A173-A177 of 63rd annual meeting of the Technical Section, Canadian Pulp and Papper Association. Montreal; Canadian Pulp and Paper Association (1977).

From 63. meeting of the Technical Section, C.P.P.A.; Montreal, Canada (1 Feb 1977).

With increasing Federal and local regulations for reduction of air emissions, ITT Rayonier has carried out an R and D program to develop improved methods of treating SO_2 vents and recovery boiler emissions, particularly from sulfite mills and also applicable in certain instances to kraft mills. Raphael Katzen Associates International, Inc., acting as chemical process engineering consultants to Rayonier has assisted in developing systems, process equipment and control designs which have now been installed and are operating commercially. Data and results of these operations are presented.

BRAYTON

REFER ALSO TO CITATION(S) 8534

PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 9363

DESIGN, DEVELOPMENT, AND OPERATION

REFER ALSO TO CITATION(S) 9152

8806 Neutron doses in an 8 MeV linear accelerator and an 18 MeV betatron. Nemec, H.W.; Roth, J. (Kantonsspital Basel (Switzerland). Abt. fuer Radiologische Physik). *Roentgenpraxis;* **31**: No. 3, 70-75(Mar 1978). (In German).

Using uranium fission track dosimeters, dose distributions of neutrons produced by photonuclear reaction in the shielding material were measured near an 8 MeV linear accelerator and an 18 MeV betatron. Dose equivalents, as a function of bremsstrahlung doses in the central beam, are given for different points outside the irradiation field, in particular at the location of the patient. The neutron production was determined as a function of photon energy between 8 and 18 MeV and compared with literature values.

8807 Overall summary. Krisch, A.D. (Univ. of Michigan, Ann Arbor). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 7-17(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

The tone of the workshop can be summarized by stressing the optimism produced by the source experts and the accelerator experts. If ZGS-type corrections for depolarizing resonances work at the AGS or PS, then one should be able to reach almost 25 GeV without serious depolarization, inject into ISABELLE or ISR, and operate near $s = 2000\ GeV^2$. If the new ion source scheme really gives a factor of 30 gain in intensity, the colliding polarized beam luminosity will be increased 1000-fold to within a factor of 10 of the present ISR luminosity. While both the above sentences start with if, there was a strong feeling that in the 1980's it might be possible to study p-p inclusive cross sections in pure spin states in clean colliding beam experiments.

8808 JAERI 20 MV tandem accelerator. Tsukada, K.; Harada, K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *Nippon Genshiryoku Gakkaishi;* **19**: No. 10, 660-666(Oct 1977). (In Japanese).

Accelerators have been developed as the experimental apparatuses for the studies on nuclei and elementary particles. One direction of the development is the acceleration of protons and electrons to more and more high energy, and another direction is the acceleration of heavy ions up to uranium to several MeV up to several hundreds MeV. However recently, accelerators are used as the useful tools for the studies in wider fields. There are electrostatic acceleration and high frequency acceleration in ion acceleration, and at present, super-large accelerators are high frequency acceleration type. In Japan Atomic Energy Research Institute, it was decided in 1975 to construct an electrostatic accelerator of tandem type in order to accelerate heavy ions. In case of the electrostatic acceleration, the construction is relatively simple, the acceleration of heavy ions is easy, the property of the ion beam is very good, and the energy is stable. Especially, the tandem type is convenient for obtaining high energy. The tandem accelerator of 20 MV terminal voltage was ordered from the National Electrostatics Corp., USA, and is expected to be completed in 1978. The significance of heavy ion acceleration in the development and research of atomic energy, tandem van de Graaff accelerators, the JAERI 20MV tandem accelerator, and the research project with this accelerator are described.

BEAM DYNAMICS, FIELD CALCULATIONS, AND ION OPTICS

8809 Limiting current of a hollow-beam phase focusing linear accelerator. Kushin, V.V.; Fedotov, P.A. *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 106-108(Mar 1978).

The phase stability as well as the dynamics of the longitudinal and transverse momentum are calculated for an accelerator with variable-phase focusing.(AIP)

8810 Frequency characteristics of a multisection linear accelerator. Beloglazov, V.I.; Vishnyakov, V.A. (Khar'kov Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 2, 234-236(Feb 1978).

Computer calculations are reported for the Khar'kov LINAC. The effect of the stability of the microwave source on the energy characteristics of the beam are computed. (AIP)

8811 Higher energy polarized proton beams. Krisch, A.D.; Salthouse, A.J. (eds.). New York; American Institute of Physics (1978). 222p. (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

The conference contained 24 papers, seven of which appeared previously in ERA. Separate abstracts were prepared for 17 papers. (JFP)

8812 Report of working group on accelerator problems. Cho, Y.; Kubischta, W.; Montague, B.W.; Turrin, A.; Courant, E.D.; Ratner, L. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 41-46(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A discussion is given on whether or not it is possible to accelerate polarized protons and/or deuterons to energies above the presently available 12 GeV/c of the ZGS and to store beams in colliding beam machines such as the ISR or ISABELLE. Topics considered include: (1) feasibility of maintaining polarization; (2) the

Siberian snake—longitudinal polarization; and (3) scenarios for polarized accelerators. (PMA)

8813 Polarized proton beams produced by hyperon decay: summary of discussions. Fidecaro, G. (CERN, Geneva). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 87-100(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A polarized proton beam produced by hyperon decay could hardly replace an accelerated beam to carry out a complete program of measurements, because of the small intensity and low polarization obtainable. However, it would be suitable for exploratory work and for specific measurements, while waiting for progress in the field of accelerators, especially if the ideas at present under discussion at FNAL in connection with the design of their polarized proton beam from hyperon decay should turn out to be correct—and this beam is able to furnish an intensity substantially higher than that foreseen at CERN—and if more efficient apparatus could be built, as indicated by the CERN groups.

8814 Depolarization during acceleration and storage of polarized protons and deuterons. Courant, E.D.; Ratner, L.G. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 101-102(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A brief outline is given covering: (1) acceleration of polarized protons to energies greater that 12 GeV/c; (2) acceleration of polarized deuterons; (3) storage and colliding polarized beams; and (4) accelerator research on depolarization using the ZGS polarized proton beams. (PMA)

8815 Topics to be studied for storing a polarized beam. Teng, L.C. (Fermilab, Princeton, NJ). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 103-104(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A brief review is given of beam depolarization processes, i.e., during injection and stacking; during storage; and due to stochastic processes. (PMA)

8816 Polarized proton beams produced by hyperon decay at very high energy. Fidecaro, G. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 133-134(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A brief review is given of methods to produce polarized proton beams, including recent and possible future studies. (PMA)

8817 Realization of acceleration of carbon nuclei obtained in a laser injector at JINR synchrotron. Anan'in, O.B.; Baldin, A.M.; Beznogikh, Yu.D. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR); Joint Inst. for Nuclear Research, Dubna (USSR)). *Kvantovaya Elektron. (Moscow);* **4**: No. 7, 1547-1549(Jul 1977). (In Russian).

The results of an experimental start were reported of a laser injector of multiple-charge ions and nuclei. The injector was installed on a synchrophasotron at the Joint Institute for Nuclear Research, Dubna, Moscow Region, U.S.S.R. The carbon nuclei obtained with the aid of the laser injector were accelerated in the synchrophasotron ring to 50 GeV and were led out therefrom onto nuclear photoemulsion layers, where traces of carbon nuclei-silver nuclei collisions were detected. Accelerated beam intensities were measured in the nodal points of the acceleration system. The intensity of the brought-out beam of carbon nuclei was about 10^5 particles per impulse.

AUXILIARIES AND COMPONENTS

8818 (BNL—24818) **Superconducting magnets in high energy physics.** Prodell, A.G. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 29p. (CONF-781025—3). Dep. NTIS, PC A03/MF A01.

From Instrument Society of America meeting; Philadelphia, PA, USA (16 Oct 1978).

The applications of superconducting magnets in high energy physics in the last ten years have made feasible developments which are vital to high energy research. These developments include high magnetic field, large volume detectors, such as bubble chambers, required for effective resolution of high energy particle trajectories, particle beam transport magnets, and superconducting focusing and bending magnets for the very high energy accelerators and storage rings needed to pursue the study of interactions between elementary particles. The acceptance of superconductivity as a proven technology in high energy physics was reinforced by the recognition that the existing large accelerators using copper-iron magnets had reached practical limits in terms of magnetic field intensity, cost, space, and energy usage, and that large-volume, high-field, copper-iron magnets were not economically feasible. Some of the superconducting magnets and associated systems being used in and being developed for high energy physics are described.

8819 (BNL—50870) **Coaxial wire measurements of the longitudinal coupling impedance.** Hahn, H.; Pedersen, F. (Brookhaven National Lab., Upton, NY (USA)). Apr 1978. Contract EY-76-C-02-0016. 24p. Dep. NTIS, PC A02/MF A01.

The measurement of the longitudinal coupling impedance of an accelerator component by coaxial wire methods is discussed. Potential errors intrinsic to this method are pointed out and analyzed. It is concluded that measurements using the transmission rather than the reflection coefficient are preferable and are expected to give adequate results in the limit of thin center conductors.

8820 (SLAC-TN—78-2) **Fundamentals of klystron testing.** Caldwell, J.W. Jr. (Stanford Linear Accelerator Center, CA (USA)). Aug 1978. Contract EY-76-C-03-0515. 90p. Dep. NTIS, PC A05/MF A01.

Fundamentals of klystron testing is a text primarily intended for the indoctrination of new klystron group test stand operators. It should significantly reduce the familiarization time of a new operator, making him an asset to the group sooner than has been experienced in the past. The new employee must appreciate the mission of SLAC before he can rightfully be expected to make a meaningful contribution to the group's effort. Thus, the introductory section acquaints the reader with basic concepts of accelerators in general, then briefly describes major physical aspects of the Stanford Linear Accelerator. Only then is his attention directed to the klystron, with its auxiliary systems, and the rudiments of klystron tube performance checks. It is presumed that the reader is acquainted with basic principles of electronics and scientific notation. However, to preserve the integrity of an indoctrination guide, tedious technical discussions and mathematical analysis have been studiously avoided. It is hoped that the new operator will continue to use the text for reference long after his indoctrination period is completed. Even the more experienced operator should find that particular sections will refresh his understanding of basic principles of klystron testing.

8821 Polarimeters: summary. Roberts, J.B. Jr. (Rice Univ., Houston, TX). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 67-86(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

The measurement of the polarization of the accelerated proton beam at the Argonne ZGS has become a straightforward procedure. However, measurement of the polarization of a proton beam accelerated in a very high energy accelerator or stored in a very high energy storage ring seemed to be a more formidable problem. Various possible methods of measuring the polarization of multihundred GeV protron and deuteron beams were studied. For proton beams several methods seemed to be feasible; in particular, those using known or calculable electromagnetic effects appeared quite promising. The choice of polarimeters for deuteron beams was more limited. Stripping the deuterons to make beams of polarized protons or neutrons whose polarization could then be measured by known techniques is a possibility. The measurement of inelastic spin effects at FERMILAB and SPS using polarized proton targets or polarized hydrogen gas jets to search for a good spin analyzer was encouraged.

8822 Polarimeter study group. Roberts, J.B. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 135(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A brief outline is given of the characteristics of proton and deuteron polarimeters in various energy ranges. (PMA)

ION SOURCES

8823 Polarized ion sources and low energy collector rings. Glavish, H.F. (ANAC Inc., Menlo Park, CA). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 47-66(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A review is given of the basic design of present day polarized ion sources, including the new colliding beam method. The discussions centered about ways to improve the beam intensity. A possible 1 mA pulsed, polarized negative ion source is formulated. The CERN polarized gas jet target is also considered. Low energy collector rings, studied in conjunction with the accelerator group were found to offer little advantage, especially in light of the advances now being made with source technology.

8824 Polarized ion sources and low energy storage. Glavish, H.F. (ANAC Inc., Menlo Park, CA). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 136-141(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

A summary of the status and performance of three types of polarized ion sources is given. These are: the atomic beam source, the colliding beam source, and the lamp-shift source. Low energy storage rings are briefly discussed. (PMA)

8825 Characteristics of EBIS in highly heavy ion source. Tawara, H.; Imamura, H. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering). *IONICS;* **3**: No. 4, 1-7(Apr 1977). (In Japanese).

The charge distribution of an electron beam ion source (EBIS) was studied. The high density electron beam from an electron gun in high vacuum (10^{-10} Torr) collides with neutral gas atoms and produces highly ionized ions. These ionized ions are confined in the electron beam, and then extracted and accelerated. The ionization in the electron beam arises mainly due to the collision of neutral gas atoms with high speed electrons. In this paper, the step-by-step ionization is considered, and the production rate of postitive ions is calculated. Evaluation of ionization cross-section is necessary, but the measurement has been scarce. The empirical formula by Lotz was used for the estimation of the cross-section. The coupling energy of electrons in shells was evaluated by using the results by Carlson et al. The charge distribution can be expressed as a function of the ionization factor, which is the product of the density of electron beam and the confinement time. The highly ionized ions increase with increase of the ionization factor. The relations between the ionization factor and collision energy, and between the factor and atomic number were obtained. Further problems on EBIS are also discussed.

8826 Ion sources and accelerating columns of high energy accelerators. Fukumoto, S.; Ishimaru, H.; Ito, K.; Kubota, C.; Sakaue, T. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). *IONICS;* **3**: No. 5, 1-7(Mar 1977). (In Japanese).

The ion sources and accelerating columns of high energy accelerators are reviewed in this paper. The accelerating columns for pre-acceleration stage are the high gradient columns with duoplasmatrons, and they contribute to obtain intense beam over 100 mA. The improvement of the pre-acceleration stage contributed to obtaining intense beams. There are two types of high gradient columns. One is the open air type, and other the dual structure pressurized type. It is hard technically to construct the former one, and the internal structure of the latter one is complicated. At present, the type of ion sources for the high energy accelerator is the duo-plasmatron type. The life term of oxide cathode is longer than several thousand hours. The study on plasma expansion cups has been made to make ion sources with high intensity and small emittance. Negative hydrogen ion injection is being investigated at ZGS and LAMPF. The acceleration of polarized proton beams is also carried out at ZGS. The negative plasma cup is used for the accelerator at KEK, Japan.

EXPERIMENTAL FACILITIES AND EQUIPMENT

REFER ALSO TO CITATION(S) 8839

8827 Pulsed neutrons at the Rutherford. Dore, J. (Kent Univ., Canterbury (UK)). *New Sci.;* **78**: No. 1099, 160-162(20 Apr 1978).

The advantages of a neutron beam facility and in particular of a pulsed neutron source as a research tool in a wide range of physical, chemical and biological topics are discussed. The Neutron Spallation Source (SNS) which is scheduled to be operational at the Rutherford Laboratory in 1982 will be just such a facility. The Electron Linear Accelerator Project at Harwell has been used as a pulsed neutron source for nuclear structure measurements since 1959 and experiments using the time-of flight spectrometer for diffraction and in-elastic scattering studies of crystalline solids, liquids and glass are mentioned. However the SNS project is designed to give an effective flux increase of around 1600 over the previous linac characteristics. This increase will result from using high-energy protons for the primary beam instead of electrons. The impact of this new facility on studies of the condensed state will be considerable and cannot be properly assessed at the present moment.

STORAGE RINGS

8828 Thermodynamic equilibrium selfphased states of a relativistic electron bunch in a storage ring. Naugol'nyi, N.N. *Zh. Tekh. Fiz.;* **47**: No. 7, 1510-1515(Jul 1977). (In Russian).

A possibility of self-phasing of charged particle relativistic beam in a storage ring at its interaction with various external passive structures is studied. The stationary solutions of soliton type have been obtained and their stability is investigated. It is shown in particular, that in the presence of passive elements with inductive coupling for energies above critical in the storage chamber, there is nonlinear limitation of soliton amplitudes, which does not depend on focusing force.

INSTRUMENTATION

RADIATION INSTRUMENTATION

REFER ALSO TO CITATION(S) 8001, 8137, 8139, 8141, 8142

GENERAL DETECTORS AND MONITORS

REFER ALSO TO CITATION(S) 8050, 8230

8829 (BNL—24411) **Azimuthal spread of the avalanche in proportional counters.** Fischer, J.; Okuno, H.; Radeka, V.; Walenta, A.H. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 3p. (CONF-781033—1). Dep. NTIS, PC A02/MF A01.

From NS symposium; Washington, DC, USA (18 Oct 1978).

The angular distribution of the avalanche around the anode wire is determined measuring the distribution of positive ions arriving on cathode strips surrounding the anode, for each single event. The width is typically 50^0 to 100^0 FWHM, in the proportional mode of operation; larger values are obtained at high gas gain. The angular distribution also depends on the anode wire diameter, the gas mixture and the space charge density in the avalanche. The factors determining the avalanche distribution around the wire and their importance for counter application, e.g., high rate behavior, signal formation and fast measurement of drift angle are discussed.

8830 (CONF-7806110—1) **LBL—7599.** Perez-Mendez, V.; Lim, C.B.; Ortendahl, D.; Hattner, R.; Kaufman, L.; Price, D.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1978. Contract W-7405-ENG-48. 9p. Dep. NTIS, PC A02/MF A01.

From 1. symposium on positron emission tomography; Montreal, Canada (2 Jun 1978).

A Multiwire Proportional Chamber (MWPC) camera for Emission Tomography with positron emitting isotopes has been built. The coincident 511 keV gammas are detected by their interaction with lead-on-plastic honeycomb converters coupled to planar MWPC detectors with sensitive area 48 x 48 cm^2 placed 50 cm apart with clear space in between for the patient. Each detector box has two MWPC: the innermost MWPC are coupled to two converters, while the outer ones have only 1 converter. This configuration leads to an effective sensitivity of 1600 coincidence cts./min./μCi. for a source placed in the center of the median plane between the detectors. With the present electronics and lead-on-plastic honeycomb converters the spatial resolution is 8 mm FWHM and the event rate at which images are taken with the camera is 30,000 to 40,000 events/min.

8831 (NUREG/CP—0004(Vol.2), pp 831-842) **Some studies of the ^{93}Nb(n,n')/sup 93m/Nb reaction.** Taylor, W.H. (Atomic Energy Establishment, Winfrith, Eng.). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The development of methods for the absolute determination of the activity induced in niobium foils by the reaction ^{93}Nb(n,n')/sup 93m/Nb is described in relation to the use of this reaction as a monitor of damage fluence in power reactors. A trial irradiation has been made in the Steam Generating Heavy Water Reactor and the results compared with theoretical prediction. The response of niobium and rhodium foils has been compared over a significant spectral range in the Prototype Fast Reactor.

8832 (NUREG/CP—0004(Vol.2), pp 873-943) **Nuclear data guide for reactor neutron metrology (edition 1977).** Zijp, W.L. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

This document lists numerical data on activation detector materials, on detection reactions involved, and on radionuclides produced. The data are mainly taken from existing evaluations. Where evaluations were missing, unknown or obsolete, data were taken from recent literature. The detection reactions considered were selected on the basis of available information of its use for reactor neutron measurements. To the opinion of the Euratom Working Group on Reactor Dosimetry this document may contribute to the creation of a common data set for all laboratories working in the field of reactor neutron metrology. It is expected that after one or two years an updated and revised guide will be issued.

8833 **Threshold of detection for various materials at 10.6μm.** Sollid, J.E.; Thomas, S.J.; Foley, E.; Phipps, C.R. Jr. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544). *Appl. Opt.;* **17**: No. 17, 2670(1 Sep 1978).

The thresholds for detection of CO_2 laser radiation were determined for various photographic films and liquid crystals. (AIP)

RADIATION DOSEMETERS

8834 (NUREG/CP—0004(Vol.2), pp 789-811) **Thermoelectric neutron dosimetry: a short introduction.** Mathieu, F. (EURATOM, Brussels); Meier, R.; Debrue, J.; Leonard, F.; Schubert, W. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The paper gives a short introduction and state-of-the-art account of an unconventional, non destructive neutron dosimetry method based on monitoring the neutron fluence dependent changes of the thermoelectric properties of base metals and alloys. The basic principles are exposed and illustrated with experimental data obtained during an exploratory irradiation in the BR2 reactor.

8835 (NUREG/CP—0004(Vol.2), pp 825-830) **Fast neutron dosimetry by the reaction ^{93}Nb(n,n'). Counting technique for ^{93}Nb activity.** Hegedeus, F. (Swiss Federal Inst. for Reactor Research, Wuerenlingen, Switzerland). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Nb-Fe-Cu activation detectors have been used, for some time, for fast neutron dosimetry measurements in a number of Swiss power reactors and the use of such detectors will continue. The use of Fe and Cu detectors leads to no particular problems but, in the case of Nb, there are difficulties related to the preparation of the detectors, the measurement of the intensity of the emitted radiation and the evaluation of the results. The main problem is that the niobium, unavoidably, contains a few ppM of tantalum. The intense Bremsstrahlung of ^{182}Ta excites the 16.6 keV x-rays of Nb which are emitted in addition to the /sup 93m/Nb radiation which is of interest. The production rate of the externally produced Nb x-rays as a function of the sample thickness and ^{182}Ta specific activity was determined. It was found that to avoid this effect it would be necessary to prepare counting samples with a thickness not greater than 0.1 to 0.5 mg/cm^2.

8836 (PNL—2449) **Sixth ERDA workshop on personnel neutron dosimetry.** (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1977. Contract EY-76-C-06-1830. 149p. (CONF-770726—). Dep. NTIS, PC A07/MF A01.

From 6. workshop on personnel neutron dosimetry; Oak Ridge, TN, USA (11 Jul 1977).

Twenty-one of the twenty-five papers are indexed separately. Four of the papers were previously included in the data base and can be found in the report number index under CONF-770726. (WHK)

8837 (PNL—2449, pp 32-39) **Personnel albedo monitor for neutrons.** Burger, G.; Morhart, A. (Institut fuer Strahlenschutz, Neuherberg, Ger.). 1977.

From 6. workshop on personnel neutron dosimetry; Oak Ridge, TN, USA (11 Jul 1977).

In Sixth ERDA workshop on personnel neutron dosimetry.

This work deals with the study, design and test of a personnel neutron monitor based on the detection of the neutron albedo fluence emerging from the human body when it is exposed to an incident fast neutron fluence. The proposed system provides sufficient sensitivity to incident neutrons of energies below 100 keV. It consists of a pair of TLD-ribbons (^{6}LiF-^{7}LiF) mounted inside a polyethylene body, in order to increase the overall sensitivity, and it is shielded by a borated resin layer to decrease the high sensitivity below 100 eV. The response of the dosimeter to monoenergetic neutrons from a 3 MeV Van de Graaff and its directional sensitivity were investigated. Phantom neutron penetration calculations were performed by means of the SN-code DOT-2 to study also the theoretical response of an albedo-system. This system, together with a ^{237}Np fission track detector and a sulfur pellet, provides adequate information to assess the maximum body dose equivalent originating from neutrons in the energy range E < 15 MeV, for routine and accidental monitoring provided that spectrum dependent correction factors are applied. The same holds in principle, however with less accuracy, for the use of the albedo dosimeter alone.

NUCLEAR SPECTROSCOPIC INSTRUMENTATION

REFER ALSO TO CITATION(S) 7448, 7450, 9152, 9183

8838 (NUREG/CP—0004(Vol.2), pp 813-824) **Fast neutron spectrometry with a drastic background discrimination.** Pinelli, T.; Fossati, F.; Berther, G.; Bracco, G.; Torre, P. (Istituto Nazionale di Fisica Nucleare, Pavia, Italy). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Two spectrometric systems have been set up with the aim of measuring fast-neutron spectra in positions where the n-field is affected by a high level background. The background discrimination is based for both systems on the identification of one of the reaction products, namely ^{3}H particle from ^{6}Li(n,α)^{3}H reaction and recoil proton from n-p elastic scattering respectively. In addition to the background discrimination effective against a sensible noise of any nature, the proposed spectrometers are characterized by the following primary qualities: (1) Capability of analyzing broad energy intervals and (2) Possibility to be built in satisfying reduced dimensions. The spectrometers have been experimentally tested by measuring the neutron spectrum produced in an uranium converter.

HIGH ENERGY PHYSICS INSTRUMENTATION

REFER ALSO TO CITATION(S) 8818

8839 (BNL—24662) **High resolution magnetic spectrometer for antiproton physics at rest and low energies.** Lowenstein, D.I.; Peaslee, D.C.; Lewis, R.A.; Miller, R.; Oh, B.Y. Pratap, M.; Smith, G.A.; Whitmore, J. (Brookhaven National Lab., Upton, NY (USA); Regents Research Fund, Inc., Albany, NY (USA); Michael Reese Hospital, Chicago, IL (USA); Syracuse Univ., NY (USA)). 1978. Contract EY-76-C-02-0016. 14p. (CONF-7806108—1). Dep. NTIS, MF A01.

From 4. European anti-proton symposium; Strasbourg, France (26 Jun 1978).

Portions of document are illegible.

A spectrometer is being installed in a high-intensity antiproton beam (LESBII) at the AGS. The beam momentum entering the target will be known to approximately +- ½%. The target is surrounded by a stereoscopic cylindrical drift chamber, and thus the total charge of the event will be measured. Since the vertex will be reconstructed with an accuracy of approximately +- 2 mm, studies of annihilations with high resolution down to approximately 150 MeV/c will be possible. On one side of the target a large-aperture (2.3 x .62 m^2) magnet covered on both sides with drift chambers and triggering—TOF scintillation counters, will measure particle and γ-ray energies with high resolution, as well as identify particles. The primary objective is to look for peaks in the γ spectra coming from annihilations at rest by converting them in a thin (.05 x_0) radiator before the magnet. Narrow peaks (< 1 MeV) which are produced with frequencies of approximately 10^{-3} or better are expected to be seen as 5 sigma effects. The principle and details of the spectrometer are presented.

8840 (CONF-781033—3) **Bellcord: a multilevel fast preprocessor for 1024 ECL channels.** Kerns, C.R. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1978. Contract EY-76-C-02-3000. 10p. Dep. NTIS, PC A02/MF A01.

From NS symposium; Washington, DC, USA (18 Oct 1978).

Portions of document are illegible.

To provide a fast decision trigger on multiple tracks passing through multiwire proportional chambers, a high-speed (arriving at an answer in 60 ns) track counting system was developed at Fermilab. The circuit is capable of selecting the track multiplicities utilizing a coaxial cable "Bus" (the Bellcord) on which fast pulses are summed. Up to 16 Bellcord coax cables, each having 64 inputs, are fanned into a central "Hub" processor where the trigger level decision is made. 7 figures.

8841 (COO—3064-010) **Experimental studies of the acoustic detection of particle showers.** Sulak, L.R.; Bowen, T.; Pifer, B. (Harvard Univ., Cambridge, MA (USA)). 1977. Contract EY-76-C-02-3064. 8p. Dep. NTIS, PC A02/MF A01.

The scale and characteristics required of a detector that will measure ultrahigh-energy cosmic ray neutrino interactions have been studied in detail. Results obtained to date in observing acoustic signals from hadronic showers both at Brookhaven National Laboratory (BNL) and Harvard University are reported. It is suggested that ultrasonic particle detection is possible, currently down to the level of 10^{14} eV. This simple, inexpensive technique may be ideal for observing the secondaries produced in a massive (10^9 ton) neutrino detector. Three experimental tests were performed to determine if showers produce detectable sonic signals as recently predicted. One at the 200-MeV linac at BNL used heavily ionizing protons stopping in water (range = 30 cm) with total energy depositions between 10^{19} and 20^{21} eV and deposition times ranging from 3 μs to 200 μs. The

diameter of the beam was fixed at 6 cm (a characteristic time of 30 μs). A similar test was done at the 160-MeV cyclotron at Harvard, where the energy deposition could be decreased to 10^{15} eV. A third test was done with minimum ionizing protons from the 28-GeV fast extracted beam at BNL. As in the BNL linac test, the beam could not be tuned below energy depositions of 10^{19}. Typically 3 x 10^{11} protons traversed 30 cm of water during a deposition time of 2 μs with a beam diameter variable between 5 and 20 cm.

RADIOMETRIC INSTRUMENTS

8842 **Test of some sorbents for thermal radiation detectors.** Levin, Y.Z.; Danilov, V.A.; Maslov, V.A. *Sov. J. Opt. Technol. (Engl. Transl.);* **45**: No. 2, 105-106(Feb 1978).

The sorbtivity of some zeolites and carbons has been tested, and recommendations are given for their use in thermal radiation detectors.

RADIATION EFFECTS ON INSTRUMENT COMPONENTS, INSTRUMENTS, OR ELECTRONIC SYSTEMS

8843 (SAND—78-0808C) **Latch-up in CMOS integrated circuits.** Estreich, D.B.; Dutton, R.W. (Sandia Labs., Albuquerque, NM (USA); Stanford Univ., CA (USA)). Apr 1978. Contract EY-76-C-04-0789. 4p. (CONF-781107—2). Dep. NTIS, PC A02/MF A01.

From Government microcircuit applications conference; Monterey, CA, USA (14 Nov 1978).

An analysis is presented of latch-up in CMOS integrated circuits. A latch-up prediction algorithm has been developed and used to evaluate methods to control latch-up. Experimental verification of the algorithm is demonstrated.

MISCELLANEOUS INSTRUMENTS

REFER ALSO TO CITATION(S) 7209, 7418, 7985, 7986, 8097, 8152, 8156, 8294, 8951

8844 (SAND—78-1032) **Long-term instability problems in adaptive noise-cancelers.** Ahmed, N.; Elliott, G.R.; Stearns, S.D. (Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EY-76-C-04-0789. 25p. Dep. NTIS, PC A02/MF A01.

The adaptive digital filter using the least-mean-square adaptive algorithm can develop some undesirable long-term characteristics when used in the noise-canceling mode. Field experience has shown that after a period of several days the adaptive noise-canceler tends to become a "no pass" filter, exhibiting an overall transfer function of near zero from dc to the Nyquist frequency. An analysis of the adaptive predictor error surface yields an understanding of this stability problem. Following the analysis, two solutions to the stability problem were developed and are being used in the field in microprocessor-based adaptive digital noise-cancelers. One solution is based upon adding a small forcing function which tends to bias each filter weight toward zero. The other solution involves injecting a small amount of broadband noise directly into the first stage of the filter, bypassing the summing junction used for error determination. The purpose of the project is to improve the performance of perimeter sensors for intrusion detection in security systems.

8845 **Pulsed spontaneous Raman scattering technique for luminous environments.** Mulac, A.J.; Flower, W.L.; Hill, R.A.; Aeschliman, D.P. (Sandia Laboratories, Albuquerque, New Mexico 87115). *Appl. Opt.;* **17**: No. 17, 2695-2699(1 Sep 1978).

A gated photon counting system, cavity-dumped argon-ion laser, and a multipass retroreflecting light cell have been combined in a system to enhance spontaneous Raman scattering in luminous background situations. Signal-to-background ratio (SBR) has been improved a factor of 450 over a single-pass cw system with cw power equal to the pulsed average power. The improvement attributable to the gating and cavity dumping the laser is a factor of 30. A factor of 15 improvement is due to the retroreflecting light cell. Temperature and density data obtained from N_2Q-branch spectra of a luminous methane—air flame are presented to illustrate the utility of the system. A passband fitting technique is introduced to analyze the data.

8846 **Gas analysis by computer-controlled microwave rotational spectrometry.** Hrubesh, L.W. (University of California, Lawrence Livermore Laboratory, Livermore, California 94550). *Appl. Spectrosc.;* **32**: No. 5, 425-429(Sep 1978).

Microwave rotational spectrometry has inherently high resolution and is thus nearly ideal for qualitative gas mixture analysis. Quantitative gas analysis is also possible by a simplified method which utilizes the ease with which molecular rotational transitions can be saturated at low microwave power densities. This article describes a computer-controlled microwave spectrometer which is used to demonstrate for the first time a totally automated analysis of a complex gas mixture. Examples are shown for a complete qualitative and quantitative analysis, in which a search of over 100 different compounds is made in less than 7 min, with sensitivity for most compounds in the 10 to 100 ppm range. This technique is expected to find increased use in view of the reduced complexity and increased reliabiity of microwave spectrometers and because of new energy-related applications for analysis of mixtures of small molecules.

WELL LOGGING INSTRUMENTATION

REFER ALSO TO CITATION(S) 7894, 7895, 7896

EXPLOSIONS AND EXPLOSIVES

CHEMICAL

8847 (SAND—78-1127) **Analysis of the motion of a barrel-tamped explosively propelled plate.** Benham, R.A. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 22p. Dep. NTIS, PC A02/MF A01.

A method for predicting the terminal velocity and rotation rate of a barrel-tamped explosively propelled plate has been developed. The technique utilizes the Gurney method of calculating an explosive mass discount factor to give a very simple set of equations for predicting the performance of a barrel-tamped explosive charge. Calculations are compared with results from numerous experiments. Velocities are calculated within +- 5% in all cases and rotation rates to within about 10% of measured values.

8848 (SAND—78-1395) **Analysis of amide complex impurity in CP explosive by infrared spectroscopy.** Jungst, R.G.; Peterson, P.K. (Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EY-76-C-04-0789. 28p. Dep. NTIS, PC A03/MF A01.

Infrared spectroscopy has been utilized in the analysis of 5-carboxamidotetrazolatopentaamminecobalt(III) perchlorate (amide complex) impurity in 5-cyanotetrazolatopentaamminecobalt(III) perchlorate (PC) explosive. Best results were obtained by running samples differentially against high purity CP or by special sample preparation involving deuteration of the ammonia in order to remove partially interfering infrared absorbances. In both methods, Nujol mull spectra were used to compare the intensity of the amide carbonyl band just above 1700 cm^{-1} to an internal reference nitrile absorption at 2266 cm^{-1}. A shift to lower energy was noted in the position of the amide peak for fine particle size freeze-dried samples recovered from H_2O or D_2O. This shift is believed to indicate entrainment of water and was eliminated by slowing the rate of evaporation of solvent when preparing samples. Calibration has been completed in the 1-15% mole fraction amide complex concentration region for differentially measured samples and in the 0.5 to 10% region for deuterated samples. The lower values in the ranges are the approximate detection limits without employing scale expansions or signal averaging. A statistical analysis indicates that the 95% confidence limits for a single future measurement using these calibrations at the 2% amide complex level are +- 0.7% for the differential and +- 0.35% for the deuteration method. The concentration range studied is appropriate for analysis of typical production batches of CP, and the methods discussed offer improvements in accuracy and detection limit (deuteration procedure) or savings in time (differential procedure) when compared to analysis by thin layer chromatography.

8849 (SAND—78-1535C) **Preliminary study of the motion of thin flyer plates accelerated by light initiated explosive.** Benham, R.A.; Mathews, F.H. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 16p. (CONF-780679—5). Dep. NTIS, MF A01.

From JOPWOG-6/SubWOG-268 meeting; Albuquerque, NM, USA (27 Jun 1978).

Portions of document are illegible.

Flyer plates of 0.37 mm thick aluminum were accelerated to velocities of approximately 0.114 mm/μs using silver acetylide-silver nitrate explosive. The explosive was spray deposited on one face of the plate and the surface initiated by an intense flash of light. Images obtained with pulsed x-rays indicate that the plate remains planar over relatively large displacements. A fiber optics transducer was used to produce displacement information during the explosive acceleration phase of plate motion. This paper presents a simplified model of the explosive multipoint initiation, detonation and expan-

sion process, thus describing the force exerted on the flyer plate. Calculations of plate motion are compared to experimental results with excellent agreement. These calculations are required for the design of a flyer plate system that will deliver a simultaneously applied surface impulse load to a test structure, creating both structural and material response.

NUCLEAR

WEAPONRY

8850 (LA-tr—78-18) **Neutron bomb, the defense of Europe and the flexible response.** Geneste, M. Translated from *Def. Natl.;* **33**: 45-57(Dec 1977). 19p. Dep. NTIS, PC A02/MF A01.

The development and tactical use of the neutron bomb are discussed. (TFD)

EXPLOSION DETECTION

REFER ALSO TO CITATION(S) 8951

8851 **System for detecting nuclear explosions.** Rawls, L.E. (to Westinghouse Electric Corp.). US Patent 4,088,998. 9 May 1978. Filed date 22 Dec 1960. 4p.

Apparatus for detecting underground nuclear explosions is described that is comprised of an antenna located in the dielectric substance of a deep waveguide in the earth and adapted to detect low frequency electromagnetic waves generated by a nuclear explosion, the deep waveguide comprising the high conductivity upper sedimentary layers of the earth, the dielectric basement rock, and a high conductivity layer of basement rock due to the increased temperature thereof at great depths, and means for receiving the electromagnetic waves detected by said antenna means.

ENVIRONMENTAL SCIENCES, ATMOSPHERIC

REFER ALSO TO CITATION(S) 8385

BASIC STUDIES

REFER ALSO TO CITATION(S) 8366

8852 (CONF-780847—1) **Sources of uncertainty in ecological models.** O'Neill, R.V.; Gardner, R.H. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 32p. Dep. NTIS, PC A03/MF A01.

From Symposium on systems methodology and simulation; Rehonot, Israel (13 Aug 1978).

Variance in model output is the result of a number of interacting causes. For purposes of the present review, we have grouped the sources under three headings: model structure, parameter error, and natural variability in ecological systems. Uncertainty associated with model structure results from constructing a simple mathematical model to describe a complex natural system. It is clear that the model can only represent limited aspects of the system behavior. Results are reviewed for error resulting from representing a two-component system by a single-variable model; for relative error propagation in alternative models for the same ecological system, and for error propagation in series of models of increasing structural complexity. Errors in the measurement of model parameters represent a second major source of uncertainty. Monte Carlo studies are reviewed on the sensitivity of variance on model outputs to variance on individual parameters, the effects of the distribution of parameter values on the distribution of output, and the propagation of parameter errors in a time-varying model and its implications for gathering validation data. Model construction and parameter measurement are errors that are introduced by the researcher. Ecological systems also contain uncertainty due to environmental (e.g., meteorological) variability, genetic variability within populations, and spatial heterogeneity. These sources of intrinsic variability also lead to errors if they are ignored in model development.

8853 (COO—1340-64) **Interannual variability of the ocean atmosphere system.** Reiter, E.R. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). 1978. Contract EY-76-S-02-1340. 15p. (CONF-780598—2). Dep. NTIS, PC A02/MF A01.

From Symposium on solar-terrestrial physics; Innstruck, Austria (29 May 1978).

Several feedback mechanisms between ocean and atmosphere are discussed, which seem to have a decisive influence on the interannual variability of the atmosphere and on climatic fluctuations on a time scale of 10 to 50 years. Satellite requirements to monitor these feedback processes are outlined briefly. It is pointed out that large sea-surface temperature (SST) anomalies in the North Pacific, but also in the North Atlantic can, at times, influence weather patterns downstream by influencing the behavior of planetary long waves. So it has been surmised that the excessively cold winter of 1976 to 1977 over the Eastern United States was to a considerable part due to a large negative SST anomaly in the central North Pacific which reached maximum proprtions during summer and fall of 1976. Preliminary research results indicate that SST anomalies can, indeed, amplify certain planetary wave patterns (mainly hemispheric wave numbers 2 and 3) if these anomalies are of the right sign and in the right location to cause resonance with orographically forced planetary wave modes.

8854 (UCRL—80901) **Objective wind field pattern characterization.** Walton, J.J.; Sherman, C.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1978. Contract W-7405-ENG-48. 14p. (CONF-780841—1). Dep. NTIS, PC A02/MF A01.

From 9. meeting on air pollution modeling and its application; Toronto, Canada (28 Aug 1978).

The method of principal components analysis provides a basis for comparison of wind field patterns at different times and for generating typical patterns when similarities are identified. The method has been used to produce wind fields to drive a transport-diffusion code.

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 7270, 7892, 8371, 8854, 8874, 8875, 8987

8855 (BNL—50877) **Environmental control technology for atmospheric carbon dioxide. Progress report No. 2, October 1, 1977—March 31, 1978.** (Brookhaven National Lab., Upton, NY (USA)). Apr 1978. Contract EY-76-C-02-0016. 27p. Dep. NTIS, PC A03/MF A01.

A methodology for systematically constructing and evaluating scenarios for controlling atmospheric carbon dioxide is described. Based on fundamental principles and a search of the literature a number of alternative processes (building blocks), ranging from conventional technologies to advanced concepts, are presented for consideration in the construction of these scenarios. Since there are several key factors to consider in evaluating alternative control strategies, such as energy requirements, disposal options, and process inefficiencies, each of which could render a particular alternative impracticable, a reasonably thorough analysis of each candidate scenario is required before meaningful conclusions can be reached. In this report, information is presented on (1) a logic structure for constructing scenarios, (2) process options for CO_2 capture, reuse, and disposal, (3) a methodology for evaluating scenarios, (4) an assessment of the energy requirements for capturing CO_2 from the atmosphere, and (5) an evaluation of a control system for removing CO_2 from power plant stack gases by adsorption with seawater, followed by deep ocean disposal.

8856 (EPRI-EC—224) **Health effects of mercury and its compounds. Quarterly report, July 1978.** Rogozen, M.; Hausknecht, D. (Science Applications, Inc., Los Angeles, CA (USA)). Apr 1977. 85p. Dep. NTIS, PC A05/MF A01.

This literature review covers chemical and physical properties of mercury and its compounds; natural and anthropogenic sources of mercury releases, including that from coal combustion; bioconversion processes and cycling in aquatic ecosystems; sampling and analytical techniques; mechanisms of toxicity; entry, distribution to and retention by target organs, and excretion; effects upon the kidney, central nervous and respiratory systems, gastrointestinal tract and skin; epidemiological studies; and occupational and environmental standards. Over 90 percent of the mercury in coal is released to the atmosphere as Hg vapor. Coal combustion for electric power generation accounts for about 12 percent of U.S. mercury emissions. A lack of data on preexisting ambient atmospheric merucry levels makes assessment difficult; however, loadings from power plant operation probably do not pose a significant human health threat. Mercury has been shown to increase significantly over preexisting or background levels in soils and sediments surrounding coal-burning power plants. Although it has been thoroughly established that this inorganic mercury can be converted by bacteria to toxic alkylmercurials, and that many forms of mercury accumulate in tissues of edible organisms, the indirect human health effects of

mercury releases from fossil fuel combustion are subject to speculation.

8857 (IIEQ—77/36) **Economic evaluation of proposed amendments to the Illinois sulfur dioxide regulations, R74-2, R75-5, and R76-9.** Cohen, A.S. (Argonne National Lab., IL (USA)). Nov 1977. Contract W-31-109-ENG-38. 120p. Dep. NTIS, PC A06/MF A01.

Portions of document are illegible.

The sulfur dioxide standards and limits for Illinois were originally adopted by the Illinois Pollution Control Board (PCB) on April 13, 1972. In March 1974 the PCB began inquiry hearings to reassess the appropriateness of Rule 204 in light of the increases in oil prices following the Arab oil embargo, the limited success of sulfur removal systems, shortages of natural gas and low sulfur coal in Illinois, and the 1975 deadline for compliance with the rule. During these and related PCB hearings a number of amendments to the sulfur dioxide regulations were proposed. On April 20, 1977, a public meeting convened in Springfield, Illinois, at the request of the Illinois Environmental Protection Agency (Illinois EPA). At this meeting certain unresolved issues arising out of the PCB hearing record were discussed. Based on this discussion the Illinois EPA redrafted its May 1976 proposed amendments to Rule 204. The provisions of the current sulfur dioxide regulation and this latest proposal served as the bases for selecting alternative control strategies, which are evaluated in this study.

8858 (LF—57) **Characterization of aerosols produced by an experimental fluidized bed coal combustor operated with sub-bituminous coal.** Carpenter, R.L.; Weissman, S.H.; Newton, G.J.; Hanson, R.L.; Peele, E.R.; Mazza, M.H.; Green, D.A.; Grimm, U. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA); Department of Energy, Morgantown, WV (USA). Morgantown Energy Research Center). Feb 1978. Contract EY-76-C-04-1013. 108p. Dep. NTIS, PC A06/MF A01.

The airborne constituents in the effluent stream of an 18" fluidized bed combustor were characterized to provide information for use in designing and evaluating control technology strategy and for predicting potential stack emissions to the general environment and fugitive emissions to the work place environment. The fluidized bed combustor was operated with Montana Rosebud, a sub-bituminous coal, as fuel and limestone as the bed material. Samples were obtained from four points in the effluent stream: the stack breech, between the baghouse and the secondary cyclone, between the primary and secondary cyclones, and at the top of the combustor in front of the primary cyclone. Samples were obtained by withdrawing a portion of the exhaust stream followed by immediate dilution with dry air in such a manner that fine particles were not lost. The diluted aerosol was conveyed to a large sampling chamber designed to obtain simultaneous representative samples of particles less than 10 μm mass median aerodynamic diameter (MMAD). Ahead of the sampling chamber, part of the stream was diverted to sample vapor-phase and particulate organics. The data were analyzed to determine aerosol size and concentration. Particle trace element composition was determined and an effort was made to quantitate and tentatively identify any organic species found. Analyses of the data indicate that the mass median aerodynamic diameter (MMAD) decreased from 4.4 +- 0.4 to 2.2 +- 0.1 μm and the loading decreased from 4.4 +- 0.8 to 7.0 +- 0.1 x 10^{-3} g/m^3. Examination of the aerosol samples using a scanning electron microscope (SEM) revealed that the particles were irregular in shape. There was little apparent difference in aerosol particle morphology as a function of sample position.

8859 (UCRL—80553) **Imposition of incompressibility constraints via variational adjustment of velocity fields.** Sani, R.L.; Gresho, P.M.; Tuerpe, D.R.; Lee, R.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1978. Contract W-7405-ENG-48. 15p. (CONF-780712—4). Dep. NTIS, PC A02/MF A01.

From Conference on numerical methods in laminar and turbulent flow; Swansea, UK (18 Jul 1978).

We have presented and demonstrated some useful numerical procedures for performing variational adjustments to velocity fields. The element-based procedure has been shown to be useful for obtaining much-improved streamline contour plots. The derived variable, domain-based procedure, using a lumped mass formulation, appears to be a viable technique for obtaining "mass consistent" wind fields from sparse observations, over complex topography in both two and three dimensions.

8860 (UCRL—81562) **Simulation of regional precipitation chemistry.** MacCracken, M.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1978. Contract W-7405-ENG-48. 28p. (CONF-780850—1). Dep. NTIS, PC A03/MF A01.

From Workshop to identify research needs on the formation of acid precipitation; Alta, UT, USA (22 Aug 1978).

At present, capabilities for comprehensive modeling of regional patterns of air quality and precipitation chemistry are seriously deficient; however improvements are being made. Elementary calculations indicate that significant limitations in the understanding of sulfur and hydrogen ion budgets pose basic dilemmas that restrict progress in modeling. Well-designed and focused field and laboratory investigations are needed so that comprehensive efforts can be carried through.

8861 **Fluorescence detection of atmospheric SO_2 using excitation by NO-γ-bands.** Michels, F.; Zetzsch, C.; Stuhl, F. (Bochum Univ. (Germany, F.R.). Lehrstuhl fuer Physikalische Chemie). *Z. Naturforsch., a;* **33**: No. 7, 782-785(Jul 1978).

A method previously applied for the detection of NO was modified to also monitor SO_2. With this method SO_2 is excited by NO-γ-bands ($A^2\Sigma^+ \rightarrow X^2$ IIr) and is detected by its subsequent fluorescence in the wavelength region from 300 to 400 nm. The results indicate a linear detection range from 4 ppb to 100 ppm in air using a time response of 100 s. The interferences from some atmospheric constituents were investigated.

8862 **Electrical air conductivity as an indicator for layers with an enhanced aerosol particle concentration in the atmosphere.** Gringel, W. (Tuebingen Univ. (Germany, F.R.). Aussenstelle Ravensburg). *Staub-Reinhalt. Luft;* **38**: No. 2, 74(Feb 1978). (In German).

8863 **Measurement of equivalent and spherical diameter of aerosols.** Straubel, H. *Staub-Reinhalt. Luft;* **38**: No. 2, 77-78(Feb 1978). (In German).

8864 **Particle size detection limit for uncharged nuclei in expansion counters.** Hollaender, W.; Schoermann, J. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Schmallenberg (Germany, F.R.). Inst. fuer Aerobiologie); Schumann, G. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Umweltphysik). *Staub-Reinhalt. Luft;* **38**: No. 2, 71-72(Feb 1978). (In German).

8865 **Microbial aerosol and its dependence on meteorological parameters.** Fischer, P.; Rueden, H.; Thofern, E. (Bonn Univ. (Germany, F.R.). Hygiene-Institut). *Staub-Reinhalt. Luft;* **38**: No. 2, 65-66(Feb 1978). (In German).

8866 **Influences of air pollution on surface waters, plants, and food.** Schneider, W.; Matter, L. (Chemisches und Lebensmitteluntersuchungsamt, Duisburg (Germany, F.R.)). *Forum Staedt-Hygiene;* **28**: No. 8, 226-229(Aug 1977). (In German).

Pollution control is an all-embracing task. The chemist participates in the determination of the disadvantageous changes of the environmental media including air, water, soil, fauna, and flora. The correlations between air- and water pollutions and the correlations between air pollution, soil contamination, and ground vegetation have been examined only partially. At a less loaded place in the urban area of Duisburg, with immission conditions similar to areas with a low density of population, the contents of lead, cadmium, copper, zinc, SO_2 in the air, the concentration of dust, the dust sedimentation, the composition of the sediments, surfacewaters, and some vegetation assays were determined. The results of the determinations were compared. In order to determine the balance of harmful substances, it was necessary to examine their contents in all environmental media including, especially in food. And official separation of the determinations seems to be of little use because of practical and economic considerations.

8867 **Aggregate air quality improvement as a measure of air pollution control agency effectiveness.** Fisher, F. pp 2-9 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Air quality data for the first five years of agency operation are examined to determine improvement and effectiveness during this period. Air quality is defined in positive terms by comparing the inverse of the actual pollutant level to the inverse of the primary standard: Air quality = 1/pollutant level/1/primary standard. To determine the change in air quality during the five year study period, linear regression of the annual data on time is used to determine a "best fit" curve. Where there are short term standards, the number of exceedances per year of each standard are used as the data points and analyzed using population data and enumeration statistics as appropriate. Where there are both annual and short term standards, two sets of data are gathered and analyzed.

8868 **Systemwide impact assessment of the northeast corridor improvement project: air quality considerations.** Chng, K.M.; Hanson, C.E.; Barnes, J.D. (Bolt Beranek and Newman Inc., Cambridge, MA). pp 10-24 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Existing rail operations in the Northeast Corridor consist of high frequency intercity and suburban passenger trains operating jointly with freight movements. The intercity passenger service is provided by AMTRAK, while suburban passenger service is provided on a contract basis to various transit authorities serving the major metropolitan areas. The tracks are presently electrified between Washington and New Haven using a 11 Kv 25 Hz catenary system. No electrification currently exists between New Haven and Boston. Power is supplied by both public utilities as well as by Cos Cob station which generates its own power. The proposed electrification program involves both switching the electrical power to 25 Kv 60 Hz source, and electrifying the New Haven-Boston section.

8869 Computer-aided quality control. Part I. Engineering significance and quality control indices. Wang, M.H. (New York State Dept. of Environmental Conservation, Albany); Wang, L.K.; Simmons, T.; Bergenthal, J. pp 66-76 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Federal and New York State air quality standards are introduced. The environmental engineering significance of controlling the major atmospheric pollutants are discussed. Major emphasis of this paper is placed on the introduction of the following mathematical models for effective air quality control: the Mitre Air Quality Index and the Extreme Value Index developed by Oak Ridge National Laboratory; and the mathematical models adopted by the Pennsylvania State Department of Health for determining the effective stack height, and the allowable emission rates of suspended particulate matter and particle fall from air contamination sources. A FORTRAN computer program is presented for the computation of the air quality control indices. This paper is one of the instructional materials prepared for the course of "Management and Planning for Pollution Abatement" being taught at Rensselaer Polytechnic Institute.

8870 Computed-aided air quality control. Part II. Predicting the dispersion of airborne effluents. Wang, L.K. (Rensselaer Polytechnic Inst., Troy, NY); Bergenthal, J.; Wang, M.H. pp 77-84 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

A FORTRAN IV computer program is presented for predicting the dispersion of airborne effluents. More specifically, the program computes the wind speed, wind direction standard deviations, plume standard deviations, plume rise, maximum ground-level pollutant concentrations, center line pollutant concentrations, crosswind pollutant concentrations, short-term pollutant concentrations, long-term pollutant concentrations, and downwind pollutant concentrations for an angular sector. An example with assumed environmental conditions is also illustrated and solved with the attached computer program.

8871 Startup and operation of the Research-Cottrell/Bahco scrubber for removal of SO_2 and particulates from flue gas at Rickenbacker Air Force Base, Columbus, Ohio. McCarthy, J.E. pp 90-94 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Since March 1976, flue gas from high sulfur coal burned in seven aging boilers at Rickenbacker Air Force Base near Columbus, Ohio, has been passing through a Bahco/Research-Cottrell scrubber which cleans both the particulates and the SO_2. When it leaves the scrubber the gas has been cleaned of more than 96 percent of its particulates and well over 90 percent of its sulfur dioxide (SO_2). These levels are well within the applicable air quality codes. The scrubber is the first of its type to be built in the United States under an agreement between A.B. Bahco Ventilation of Sweden, which developed the basic process, and Research-Cottrell, which has exclusive rights in the United States and Canada. At Rickenbacker Air Force Base the scrubber is applied to flue gas from coal containing about 3.5 percent sulfur. The system is designed for 5 percent sulfur coal. In other parts of the world, 19 Bahco units are in successful operation or under construction to clean gas from combustion of oil, wood, sludge and from industrial processes. Cumulative operating records total more than 500,000 hours. Startup problems were minimal and performance, to date, has exceeded guarantees. This paper describes the basic Bahco System, the Bahco unit installed at Rickenbacker Air Force Base, startup experience, and operating experience.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 8854, 8929, 8931, 8933, 8934, 8935, 8936, 8937, 8938

8872 (CONF-770491—, pp 66-79) **Report of the panel on practical problems in actinide biology.** Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

Practical problems are classified as the need to make operational decisions, the need for regulatory assessment either of individual facilities or of generic actions, and the overt appearance of radiobiological effects in man or radioactivity in man or the environment. Topics discussed are as follows: simulated reactor accident; long term effects of low doses; effects of repeated exposures to actinides; inhaled uranium mine air contaminants; metabolism and dosimetry; environmental equilibrium models; patterns of alpha dosimetry; internal dose calculations; interfaces between actinide biology and environmental studies; removal of actinides deposited in the body; and research needs related to uranium isotopes. (HLW)

THERMAL EFFLUENTS MONITORING AND TRANSPORT

8873 (CONF-781106—1) **Meteorological effects of heat and moisture releases from large power stations (precipitation modification).** Patrinos, A.A.N.; Eissenberg, D.M. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-740-ENG-26. 29p. (CONF-780520—6). Dep. NTIS, PC A03/MF A01.

From Meeting on thermal power plant heat rejection systems; Yerovan, USSR (10 Nov 1978).

The Bowen Electric Generating Plant (Plant Bowen) in Northwest Georgia has been chosen as a test site to investigate the atmospheric effects of cooling towers. This 3,200-MWe coal-fired power plant uses four natural-draft cooling towers and is the largest of U.S. power plants having cooling towers as the sole cooling method. Results are reported from both climatological and field studies. Extensive use has been made of the U.S. National Weather Service (NWS) data accumulated over several decades in Northwest Georgia. Apart from providing preliminary indications of precipitation modification effects, these data have aided in the general understanding of the climatology in the vicinity of Plant Bowen and have paved the way for the field studies currently underway. These field studies, employing a dense network of rain gauges and windsets, are expected to provide the statistical data base necessary to estimate the plant's effect (if any) on precipitation.

REGULATIONS

REFER ALSO TO CITATION(S) 8870, 8872, 8933

8874 Air pollution meteorology and the clean air act amendments of 1976. Roffman, A. (Westinghouse Electric Corp., Pittsburgh). pp 1 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Although the 94th Congress did not finalize and adopt these amendments, it is important to evaluate the implications associated with them since, in all likelihood, these or very similar amendments will be adopted in the coming year. The purpose of this paper is to evaluate various aspects associated with the suggested Clean Air Act amendments and to put them in perspective from the view point of air pollution meteorology. In particular, this paper includes a discussion of: air pollution dispersion modeling and meteorological issues and their relationship to the suggested amendments and enforcement issues related to the suggested amendments through ambient air quality monitoring.

8875 Planning chemical monitoring programs for industrial facilities and electric power plants. Roffman, H.K. (Westinghouse Environmental Systems Dept., Pittsburgh). pp 32-35 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Industrial installations, including electric power generating plants, are required by local, state or federal regulatory agencies to monitor the chemical content of emissions to the air and discharges to water bodies. Monitoring programs must be designed to monitor

relevant chemical parameters, sampiing procedures must be suited to the chemical or physical properties of the monitored chemicals, and chemical analysis must be done as soon as possible after sampling so that potential environmental hazards can be detected immediately and appropriate action taken without further damage to the environment. It is important that a carefully prepared, comprehensive monitoring program be developed. Such a program must identify the relevant and applicable elements and compounds to be monitored, as well as proper and specific procedures for both monitoring and analyses. If lacking in adequate expertise and proper planning, the purposes of a monitoring program will be inadequately fulfilled. In this paper the important steps in designing an environmentally suitable, cost-effective monitoring program are discussed.

8876 Cost-effectiveness evaluation of alternatives in environmental impact statements. Weiser, A.L. (Automation Industries, Inc., Richland, WA). pp 46-51 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

Although it has been Federal government officials who have been accused in courts of law with mismanagement with regard to the consideration of alternatives in the environmental impact statement, the responsibility for systematically considering all alternatives to a proposed project remains with project decisionmakers in the Federal, state, or local levels of government and in industry. By applying the techniques of system cost-effectiveness analysis to the assessment of alternatives, it is believed that management will be able to clearly demonstrate that the selection of the proposed approach was neither arbitrary nor capricious. A rational approach to the assessment of alternatives should aid in meeting the mandates of environmental legislation and EIS guidelines, and it should eliminate the merit of any plaintiff's charge of mismanagement with regard to management's consideration of alternatives. Even though many interfaces between the proposed system and the environment cannot as yet be objectively quantified, application of CE techniques will demonstrate that a rigorous exploration and objective evaluation has been applied to the consideration of alternatives with respect to project objectives, financial conditions, and adverse environmental impacts (costs).

ENVIRONMENTAL SCIENCES, TERRESTRIAL

BASIC STUDIES

REFER ALSO TO CITATION(S) 8366, 8852

8877 (EDFB/IBP—77/7) **Eastern deciduous forest biome progress report, September 1, 1975—August 31, 1976.** Burgess, R.L.; Tarr, N.E. (eds.). (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 204p. Dep. NTIS, PC A10/MF A01.

The report concentrates on the six projects as well as results from synthesis activities at the Lake George, Lake Wingra, and Oak Ridge sites. The centralized analysis and modeling component and the Eastern Decidious Forest Biome Information Center progress during the past year are also addressed. The project on belowground dynamics of ecosystems is investigating the allocation of phytosynthetic products into fixed or labile storage pools. Root sampling, radioactive tracer techniques, and biochemical analyses are leading to an understanding of complete tree physioogy requisite for interpreting forest growth in different environments. The Role of Consumers project has begun to document the regulatory role of heterotrophs in an array of ecosystem niches. Decomposition of woody substrates, studies of the contribution of canopy and litter arthropods to material processing, and the flow and remineralization of phosphorus in lake systems are leading to a comprehensive understanding of the role of consumer organisms in ecosystem function. The Microdynamics of Detritus project continues its investigations of carbon and nitrogen dynamics in freshwater lakes. Examination of potential pathways of detritus processing is illustrating the parts that physical and biological processes play in the breakdown of organic materials.

8878 Energy technologies and natural environments: the search for compatibility. Harte, J.; Jassby, A. (Lawrence Berkeley Lab., CA). *Annu. Rev. Energy;* **3**: 101-146(1978).

Several common themes emerge from this overview. Ecological effects arising from habitat loss are difficult to assess accurately because habitat loss is a slow process of chipping away of life support systems for wildlife. Yet the integrated process leads to sizeable destruction of natural habitat. In general, stresses on ecosystems do not act in isolation from stresses due to natural fluctuations such as rainfall and temperature. The synergistic effects resulting from the coupling of energy-related and natural stresses is very poorly understood. Both better background statistical information about natural fluctuations in space and time, and far more field observation during conditions of combined man-made and natural stress will be needed to reduce significantly the important uncertainties here. Uncertainties differ greatly within the three types of impact reviewed--stress, ecological effects, and human consequences. Stresses have received the most attention and are the best understood, while human consequence of ecological degradation are largely ignored and are most poorly understood. Of course, qualitatively, that is the way it must be, for you cannot understand effects without understanding the stresses, and you cannot understand consequences without knowing the effects. Yet the degree of imbalance is unnecessary, and without far greater emphasis on effects and human consequences and true cost to society of our energy systems will continue to go unnoticed. 123 references. (PCS)

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 7271, 8866

8879 (CONF-780839—1) **Review of compartmental analysis in ecosystem science.** O'Neill, R.V. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 38p. Dep. NTIS, PC A03/MF A01.

From International Statistical Society; Parma, Italy (Aug 1978).

The compartment model has a large number of applications in ecosystem science. An attempt is made to outline the problem areas and objectives for which this type of model has particular advantages. The areas identified are an adequate model of tracer movement through an undisturbed but non-equilibrium ecosystem; an adequate model of the movement of material in greater than tracer quantity through an ecosystem near steady state; a minimal model based on limited data; a tool for extrapolating past trends; a framework for the summarization of large data sets; and a theoretical tool for exploring and comparing limited aspects of ecosystem dynamics. The review is set in an historical perspective which helps explain why these models were adopted in ecology. References are also provided to literature which documents available mathematical techniques in an ecological context.

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 8929, 8931, 8933, 8934, 8935, 8936, 8938

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 7272, 7274, 8377

REGULATIONS

REFER ALSO TO CITATION(S) 8876

ENVIRONMENTAL SCIENCES, AQUATIC

BASIC STUDIES

REFER ALSO TO CITATION(S) 8366, 8852, 8877

CHEMICALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 7270, 7271, 7352, 7353, 8866, 8879, 8946

8880 Solving stream pollution control problems with digital computer and modelling techniques. Wang, L.K. (Rensselaer Polytechnic Inst., Troy, NY); Wang, M.H.; Bergenthal, J.F. pp 29-31 of

Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

The dissolved oxygen drop is a function of the combined BOD loads of upstream, the temperature of stream water and the stream flow. A mathematical model which adequately expresses this function can be developed by means of the multiple linear correlation method. This paper describes the procedures used for modeling and for controlling the stream pollution. Practical examples are presented and discussed.

8881 Determination of the toxicity of industrial effluents using an onsite biossay system. Drawas, N.; Herbst, R.P. (Environmental Research and Tech., Inc., Lexington, MA). pp 36-40 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

The following topics are discussed: regulations for issuing permit from the National Pollutant Discharge Elimination System; usefulness and quality of effluent bioassay by federal and state agencies; design of bioassay trailer; water quality monitoring; determination of toxicity of effluent to fish and other aquatic organisms as a method of bioassay; and the future of effluent bioassays. (HLW)

RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

REFER ALSO TO CITATION(S) 8929, 8931, 8933, 8934, 8935, 8936, 8938

8882 (ORNL/TM—6542) **Analysis of infrequent hydrologic events with regard to existing streamflow monitoring capabilities in White Oak Creek watershed.** Edgar, D.E. (Oak Ridge National Lab., TN (USA)). Oct 1978. Contract W-7405-ENG-26. 52p. Dep. NTIS, PC A04/MF A01.

The quantity and concentration of radionuclides released to the environment by ORNL must be monitored continuously and accurately in order to ensure compliance with legal requirements established by Federal and state guidelines. Of the five streamflow monitoring stations located within White Oak Creek watershed, stations 3, 4, and 5 are of primary importance in quantifying the flux of water, sediment, and radionuclides through the drainage basin. Currently, the maximum measurable discharge at these three stations is 1.42 m^3/sec (50 cfs), 0.54 m^3/sec (19 cfs), and 4.25 m^3/sec (150 cfs), respectively. Estimates of flood magnitude and frequency indicate that even small floods which are expected to recur often are significantly larger than the existing monitoring system can measure. Several independent studies have shown that most of the sediment transported from a watershed is carried by larger, less frequent streamflows which occur only a small percentage of the time. It also has been shown that certain radionuclides are transported in association with fluvial sediment. Thus, the flux of radionuclides, both in solution and associated with sediment, increases significantly during flood conditions. Estimates of peak discharges resulting from recent storms indicate that the drainage system has experienced variable flood conditions during the past few years for which no accurate and reliable records exist.

WATER

8883 (LA-UR—78-2147) **Lead isotopes as indicators of environmental contamination from the uranium mining and milling industry in the Grants Mineral Belt, New Mexico.** Curtis, D.B.; Gancarz, A.J. (Los Alamos Scientific Lab., NM (USA)). 1978. Contract W-7405-ENG-36. 8p. (CONF-780740—4). Dep. NTIS, PC A02/MF A01.

From Management, stabilization, and environmental impact of uranium mill trailings; Albuquerque, NM, USA (24 Jul 1978).

The unique isotopic composition of lead from uranium ores can be useful in studying the impact of ore processing effluents on the environment. Common lead on the earth's surface is composed of 1.4% ^{204}Pb, 24.1% ^{206}Pb, 22.1% ^{207}Pb, and 52.4% ^{208}Pb. In contrast, lead associated with young uranium ores may contain as much as 95% ^{206}Pb. These extreme differences provide the means to quantitatively evaluate the amount of lead introduced into the environment from the mining and milling of uranium ores by measuring variations of the isotopic composition of lead in environmental samples. The use of Pb isotopes as diagnostic tools in studying the hydrologic transport of materials from U ore dressing plants in the Grants Mineral Belt, New Mexico, is discussed. Preliminary measurements on effluents intimately associated with processing wastes are consistent with a simple model in which radiogenic lead from the ores is mixed with common lead from the uncontaminated environments.

SITE RESOURCE AND USE STUDIES

REFER ALSO TO CITATION(S) 7898, 8878

8884 Environmental impacts of industrial energy systems in the coastal zone. Hall, C.A.S. (Cornell Univ., Ithaca, NY); Howarth, R.; Moore, B. III; Voeroesmarty, C.J. *Annu. Rev. Energy;* **3**: 395-475(1978).

Impacts from energy-related industry situated or operating in coastal regions are reviewed. Aquatic ecosystems response to primary and synergistic effects have been assessed for petroleum industry wastes as well as for clean-up and abatement efforts. Power plant impacts have been found to be extremely site-dependent, and need for universal environmental standards has not been shown. 673 notes and references. (PCS)

REGULATIONS

REFER ALSO TO CITATION(S) 8876, 8881

8885 Regulatory thinking and offshore resource development. Mahmood, A.; Simmons, G.M.; Meadow, H.M. pp 58-59 of Environmental technology '77. Mt. Prospect, IL; Institute of Environmental Sciences (1977).

From 23. IES annual technical meeting and exposition; Los Angeles, CA, USA (24 Apr 1977).

The following topics are discussed: monitoring petroleum exploration in offshore environment; regulations for assessment of cultural resources by geophysical surveys; biological surveys prior to drilling; shallow site hazards; impact of present regulations; and deficiencies in present regulations. (HLW)

ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 8366, 8369

SOCIAL AND ECONOMIC STUDIES

REFER ALSO TO CITATION(S) 8211, 8351, 8352

ASSESSMENT OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 8855, 8878, 8884

BIOMEDICAL SCIENCES, BASIC STUDIES

BEHAVIORAL BIOLOGY

8886 (LA-UR—78-2211) **Metric universality in nonlinear recurrence.** Feigenbaum, M.J. (Los Alamos Scientific Lab., NM (USA)). 1977. Contract W-7405-ENG-36. 5p. (CONF-770692—4). Dep. NTIS, PC A02/MF A01.

From International conference on stochastic behavior and quantum hamiltonian systems; Tremezzo, Italy (20 Jun 1977).

A brief resume of some new, universal features of recurrence relations is presented in a context of possible biological consequences. 1 figure.

BIOCHEMISTRY

REFER ALSO TO CITATION(S) 8903, 8906, 8917, 8947

8887 (BNL—24807) **Reagents for the semi-synthesis of polypeptides in aqueous media.** Glass, J.D.; Pelzig, M.; Pande, C.S. (Mount Sinai School of Medicine, New York (USA); Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 7p. (CONF-780940—1). Dep. NTIS, PC A02/MF A01.

From 15 peptide symposium; Gdansk, Poland (4 Sep 1978).

After consideration of the requirements for compatibility with aqueous and organic solvent media and for exposure of bound

polypeptides to enzymes in solution, we selected polyethyleneglycol as a carrier. Bayer and his coworkers have demonstrated the advantages of this polymer as a support in liquid-phase stepwise peptide synthesis. In order to leave the C- and N- termini of peptide intermediates available for bidirectional extension of the peptide chain attachments to the polymer were made through amino acid side-chain functional groups. We have developed a series of bifunctional reagents in which one functional group of each molecule is used to covalently attach it to the polymer. The second functional group of each molecule is a chemical ligand capable of specifically reacting with one type of amino acid side chain to form a reversible, covalent linkage. Ligands specific for the thiol group, for the guanidino group, and for the amino group have been prepared.

8888 (CONF-780741—4) **Electron spin echo spectroscopy and photosynthesis.** Norris, J.R.; Thurnauer, M.C.; Bowman, M.K.; Trifunac, A.D. (Argonne National Lab., IL (USA)). 1978. Contract W-31-109-ENG-38. 12p. Dep. NTIS, PC A02/MF A01.

From Frontiers of biological energetics(electrons to tissues; Philadelphia, PA, USA (19 Jul 1978).

We have applied the high-power ESE technique to primary photosynthesis observing stationary state signals arising from the primary donor, the primary acceptors, and the triplet state observed in R. rubrum. In addition, we have performed nanosecond time-resolved ESE-EPR studies of green plant photosynthesis. ESE is a form of pulsed high-power EPR. Thus, systems studied by EPR are usually suitable for study by ESE. The ESE method employs repetitive trains of two or three intense microwave pulses to induce signals in paramagnetic samples known as echoes. Our ESE spectrometer utilizes ten-watt microwave pulses, 20 to 60 nsec wide. The most common pulse sequence is the 90°, T, 180° two-pulse sequence where T is the time between the two pulses. In our spectrometer the 90° pulse (P_{90}) is approximately 30 nsec wide. Before P_{90} the net magnetization M/sub z/ is aligned only along the external magnetic field direction z. P_{90}, as its name implies, rotates the resonant electron spins of M/sub z/ 90° such that immediately after the pulse these spins are in the x,y plane normal to the magnetic field.

8889 (COO—3085-63) **Convergent chemical grades of neoplasticity in two types of neoplasms.** Knox, W.E. (New England Deaconess Hospital, Boston, MA (USA). Cancer Research Inst.). 1978. Contract EY-76-S-02-3085. 16p. (CONF-780576—2). Dep. NTIS, PC A02/MF A01.

From Symposium on biological markers of nelplasia basic and applied aspects; Leesburg, VA, USA (22 May 1978).

Detailed comparisons of the chemical compositions of normal and neoplastic rat tissues show that two kinds of neoplasms deviate from their tissues of origin in the same general way and in proportion to their grade of neoplasticity, and that the highest grades converge to a common composition. The latter resembles that of immature tissues. These relationships are found to be compatible with those underlying the morphological model of neoplasia and also with the biochemistry of hepatomas. The results emphasize that the composition of a neoplasm, and its chemical markers, are determined simultaneously by its cell of origin and its grade of neoplasticity.

8890 (UR—3490-1411) **Biochemical observations on methylene chloride-induced fatty liver.** Morris, J.B. (Rochester Univ., NY (USA)). 1976. Contract EY-76-C-02-3490. 61p. Dep. NTIS, PC A04/MF A01.

Thesis.

The fatty liver induced by methylene chloride was investigated by studying the effects of this solvent on each of the pathways of hepatic fatty acid metabolism suggested by Slater. Male guinea pigs were exposed to approximately 5000 ppm CH_2Cl_2 or to room air for 6 hours. The animals were sacrificed; the livers removed, and in addition to biochemical measurements, were subjected to histologic examination in an attempt to confirm the biochemical findings. An increased lipid content in hepatocytes from exposed animals was seen in liver sections stained with toluidine blue and by electron microscopy. Hepatic TG levels in exposed animals were 2.4-fold higher than in control. Mitochondrial function, as measured by their ability to maintain a positive potassium ion concentration gradient in a K^+-depleted medium, and to reaccumulate K^+ when it was added to the medium was unimpaired in exposed animals. Serum free fatty acid concentrations were also unaffected by methylene chloride inhalation. Triglyceride synthesis and secretion rates, measured in vitro, were the same in both control and exposed animals. Incorporation of ^{14}C-palmitic acid into TG and secretion by liver slices of this moiety into the incubation medium was unaffected by prior CH_2Cl_2 inhalation. The phospholipid concentration in the livers of exposed animals was slightly higher than that of controls.

8891 **Chromosome replication during the division cycle in slowly growing, steady-state cultures of three Escherichia coli B/r strains.** Kubitschek, H.E.; Newman, C.N. (Argonne National Lab., IL). *J. Bacteriol.;* **136**: No. 1, 179-180(Oct 1978).

The period of DNA synthesis C during the cell cycle was determined over a broad range of generation times in slowly growing, steady-state batch cultures in the exponential phase and in chemostat cultures of three strains of Escherichia coli, strains B/r A, B/r K, and B/r TT, utilizing measurements of average amounts of DNA per cell and cell survival after radioactive decay of ^{125}I incorporated into the DNA of synthesizing cells. At each growth rate, values for cell survival and for C periods were the same within experimental errors for the three strains. The length of the DNA synthesis period increased linearly with generation (doubling) time T of the culture and approached a limiting value of C = 0.36T at very long generation times. In very slowly growing cultures, DNA replication was limited almost entirely to the final third of the cell cycle. D periods, between termination of DNA replication and cell division, were found to be relatively short at all growth rates for each strain. Average amounts of DNA per cell measured in slowly growing cultures of strains B/r A and B/r TT were indistinguishable from results for strain B/r K at the same growth rates. Amounts of DNA per cell calculated from the cell survival values alone are completely consistent with the measured values of DNA per cell.

8892 **Discrete fragments produced by limited digestion of superhelical PM2 DNA with venom phosphodiesterade. Cleavage sites and ode of generation.** Pritchard, A.E.; Laskowski, M. Sr. (Roswell Park Memorial Inst., Buffalo). *J. Biol. Chem.;* **253**: No. 18, 6606-6613(25 Sep 1978).

Limited digestion of superhelical (form I) PM2 DNA by venom phosphodiesterase yields unit length linear (form III) molecules plus a series of discrete fragments. The positions of eight of these fragments on the genome map were determined with the use of restriction endonucleases Hpa II and Hind III. These positions were compared with the locations of the eight early denaturation regions in form I PM2 DNA which have been determined previously. Five phosphodiesterase-susceptible sites were identified and four of these are at or near early denaturation regions but one is not. The fragments produced by phosphodiesterase can be paired so that the sum of each pairs' molecular weights is that of intact PM2 DNA. Only one member of each pair is susceptible to Hpa II, known to cleave PM2 DNA at a single locus, and the two members of each pair are produced in equimolar amounts. Therefore, each fragment is generated by two nearly simultaneous cleavages of form I PM2 DNA. For each fragment, one cleavage occurs at 15% on the genome map, and the other at either 62%, 72%, 78% or 85%. Digestion at low Mg^{2+} concentration generates unit length form III but not fragmented DNA. The ratio of unit length to fragmented form III DNA is independent of enzyme concentration over a range of at least 50-fold. Models accounting for the enzymatic mechanism and the role of the tertiary structure of PM2 DNA are discussed.

8893 **Conversion of glucose to sorbitol and fructose by liver-derived cells in culture.** Levine, G.A.; Bissell, M.J.; Bissell, D.M. (Univ. of California, San Francisco). *J. Biol. Chem.;* **253**: No. 17, 5985-5989(10 Sep 1978).

Conversion of glucose to fructose and sorbitol is documented in rat hepatoma-derived cultured cells (HTC cells). After addition of 5.5 mM [U-^{14}C]glucose to incubation medium, labeled sorbitol and fructose accumulated intracellularly at a linear rate over a period of 60 min. The sugars were isolated, identified, and quantitated by paper chromatography, gas-liquid chromatography, and enzymatic phosphorylation of fructose. Primary culture of adult rat hepatocytes was analyzed similarly and demonstrated no significant accumulation of labeled fructose or sorbitol. The basis for this difference between HTC cells and primary hepatocyte culture was examined both in terms of enzyme activities that mediate the formation of sorbitol and fructose and in terms of the catabolism of these sugars. Both types of culture (as well as extracts of intact rat liver) exhibited enzymatic activities catalyzing the conversion of glucose to sorbitol (aldose reductase) and sorbitol to fructose (sorbitol dehydrogenase). However, the cultures differed strikingly with regard to the catabolism of sorbitol and fructose. The conversion of labeled sorbitol to metabolites in HTC cells was negligible; by contrast, hepatocytes in primary culture utilized the sugars at rates comparable to that of glucose, which may account for the lack of their accumulation in primary culture. The findings suggest that the conversion of glucose to sorbitol and fructose by HTC cells may represent a retained normal liver function, one which is amplified by the inability of HTC cells to dispose of these sugars.

8894 **Glutamine synthetase from rat liver. Purification, properties, and preparation of specific antisera.** Deuel, T.F.; Louie, M.; Lerner, A. (Univ. of Chicago). *J. Biol. Chem.;* **253**: No. 17, 6111-6118(10 Sep 1978).

As the initial aspect of investigations on the regulation of glutamine synthetase in rat hepatomas and in hepatoma cell culture systems, glutamine synthetase from rat liver was purified to apparent homogeneity. A single protein band is found in gels after electrophoresis in three separate systems, and a constant enzyme specific activity is found in fractions containing glutamine synthetase activity

eluting from a hydroxylapatite column. The properties of crude liver enzyme and the purified protein were compared with those previously described. No differences were found, suggesting that the protein retained essential catalytic and regulatory properties through the different purification procedures used. The apparent K/sub m/ of the enzyme for l-glutamate varied over 10-fold depending upon the concentration of divalent cation used for assay. At 8 mM Mn^{2+}, the apparent K/sub m/ for glutamate is 0.3 mM, whereas at an Mn^{2+} concentration of 2 mM, the apparent K/sub m/ for glutamate is 5 mM. Similar changes in the apparent K/sub m/ for glutamate are also noted with different concentrations of Mg^{2+}.

8895 Abnormal dietary regulation of glutamine synthetase in rat hepatomas. Louie, M.; Deuel, T.F.; Morris, H.P. (Univ. of Chicago). *J. Biol. Chem.;* **253**: No. 17, 6119-6124(10 Sep 1978).

The kinetic, immunologic, and regulatory properties of glutamine synthetase from partially purified extracts of Morris hepatomas, host rat livers, and control rat livers were compared. No differences in the kinetic or immunological properties of the enzymes from the three sources were found. When tumor-bearing rats were placed on a protein-free diet, the specific activity of glutamine synthetase in the host livers fell to one-half to one-third of the specific activity in livers of tumor-bearing rats on a normal protein diet. In contrast, the specific activity of the enzyme in the hepatomas in the protein-starved rats increased in comparison to the specific activity of the enzyme in hepatomas of the rats on a normal protein diet. Immunological titration analysis revealed that the same amount of rabbit antiserum to glutamine synthetase precipitated an equivalent amount of enzyme from partially purified extracts of control rat livers, host rat livers, and hepatomas. The differences in enzyme specific activity measured thus appear to reflect differences in the steady state levels of glutamine synthetase enzyme protein in the liver and hepatomas.

8896 Serum protein bound carbohydrates for following the course of disease in patients with metastatic breast carcinoma. Waalkes, T.P. (Johns Hopkins Oncology Center, Baltimore); Mrochek, J.E.; Dinsmore, S.R.; Tormey, D.C. *J. Natl. Cancer Inst.;* **61**: No. 3, 703-707(Sep 1978).

Serum protein-bound carbohydrates, L-fucose, sialic acid, D-galactose, and D-mannose, were measured as potential biologic markers in patients with breast cancer with the use of high-resolution anion exchange separation in combination with a sensitive cerate oxidimetric fluorescence detector system. For 22 randomly selected patients with proved metastatic breast cancer, both L-fucose and sialic acid levels were above the normal range in 21 patients (95%). In contrast, D-mannose was increased in the sera of 9 patients (41%), and D-galactose in 6 (27%). By comparison, the level of carcinoembryonic antigen (CEA) was elevated in 14 patients (64%). The levels for serially determined serum protein-bound carbohydrates paralleled objective changes of response or progression in 5 patients with measurable disease. As might be expected, the degree and pattern of elevation for the individual carbohydrates varied for each patient studied. Combinations of serum protein-bound carbohydrates, particularly L-fucose and sialic acid, and, in addition, CEA, appear to have promise as potential biomarkers for following the course of the disease in patients with metastatic breast cancer.

8897 Large scale partial purification and molecular and kinetic properties of the (Na + K)-activated adenosine triphosphatase from Artemia salina nauplii. Peterson, G.L.; Ewing, R.D.; Hootman, S.R.; Conte, F.P. (Oregon State Univ., Corvallis). *J. Biol. Chem.;* **253**: No. 13, 4762-4770(10 Jul 1978).

The sodium-potassium coupled transport enzyme (NaK-ATPase) has been partially purified from the nauplius larva of the brine shrimp, Artemia salina, by treatment of isolated membranes with deoxycholate, followed by a new freeze-thaw procedure. The enzyme remains in the particulate or vesicular state throughout and is stable. Purification is up to 200-fold (relative to the homogenate), with a yield of 10 mg of protein from 200 g, wet weight, of brine shrimp nauplii. The enzyme preparations have specific activities up to 475 μmol of P/sub i//h/mg of protein, with an estimated 50% purity, assuming both the large and small subunits are the protein constituents of the holoenzyme. The kinetic properties of the brine shrimp NaK-ATPase are not altered during purification. Two proteins enrich during purification, the larger of which is identified as the catalytic subunit by its potassium-sensitive, (Na + Mg)-dependent phosphorylation from [γ-^{32}P]ATP. The smaller subunit stains positively with the periodic acid-Schiff reagent, indicating it is a glycoprotein. On sodium dodecyl sulfate-polyacrylamide gels, the larger has an apparent molecular weight of 95,000 to 101,000 and the smaller an apparent molecular weight of 38,000 to 40,000. The mass ratio is estimated to be greater than two, corresponding to a molar ratio of one large to one small subunit. Binding studies indicate that the preparation has an equivalent number of phosphorylation sites and ATP binding sites.

8898 DNA chain flexibility and the structure of chromatin ν-bodies. Harrington, R.E. (Oak Ridge National Lab., TN). *Nucleic Acids Res.;* **4**: No. 10, 3519-3535(Oct 1977).

The persistence length of high-molecular-weight, monodisperse-bihelical DNA has been evaluated from low-shear flow birefringence and viscosity data at several temperatures in 2.0 M NaCl neutral pH buffer. At these solvent conditions, both the DNA and histone components of chromatin ν-bodies have structural features similar to those in the intact nucleohistone complex at low ionic strength. The theory of Landau and Lifshitz is used to relate the experimental results to the thermodynamic functions for bending 140 nucleotide pairs of DNA into a plausible model structure: per ν-body, ΔG/sub b/ = 43.8 +- 5.3 kcal/mole, ΔH/sub b/ = 45.7 +- 3.7 kcal/mole, and ΔS/sub b/ = 6.2 +- 12.4 entropy units. This bending free energy is comparable to or less than that estimated to be required for a kinked DNA configuration and appears to be well within the range of estimated electrostatic free energies available from DNA-histone interactions in a ν-body assembly.

8899 Chemical modification of bacteriorhodopsin with N-bromosuccinimide. Konishi, T.; Packer, L. (Univ. of California, Berkeley). *FEBS (Fed. Eur. Biochem. Soc.) Lett.;* **79**: No. 2, 369-373(Jul 1977).

In the present study the effect of a tryptophan specific reagent, N-bromosuccinimide, on bacteriorhodopsin has been investigated. Correlation of chemical modification of tryptophan residues by this reagent with measurements of the formation of the 412 nm photoreaction cycle intermediate and chromophore absorption, reveal that tryptophan residues are essential for proton pump activity.

8900 Particle distribution of human serum high density lipoproteins. Anderson, D.W.; Nichols, A.V.; Forte, T.M.; Lindgren, F.T. (Univ. of California, Berkeley). *Biochim. Biophys. Acta;* **493**: 55-68(1977).

Density gradient ultracentrifugation of human serum high density lipoproteins (HDL) from both normolipemic males and females results in a distribution of HDL concentration versus subfraction hydrated density which has three maxima. Gradient gel electrophoresis of total HDL is characterized by three banding maxima, the positions of which suggest the presence of three particle size ranges: I. 10.8 to 12.0 nm, II. 9.7 to 10.7 nm, and III. 8.5 to 9.6 nm. Gradient gel electrophoresis of density gradient subfractions established an inverse relationship between particle size and particle hydrated density which was corroborated by electron microscopy and analytic ultracentrifugation. Comparison of male HDL from size range I, II, and III with female HDL from the same size ranges showed only small differences in the mean value of the peak $F^0_{1.20}$ rate, size, molecular weight, protein weight percent, and weight protein/weight phospholipid. Major differences between males and females were seen in the relative amounts of HDL in density gradient subfractions 1 to 3 (size range I material) and 11 to 12 (size range III material); the percent total HDL in the group of subfractions 1 to 3 was greatly increased in female HDL while that of the group of subfractions 11 to 12 was increased in the male HDL. These studies indicate the presence of at least three major components in HDL instead of two (HDL_2 and HDL_3) and that peak $F^0_{1.20}$ rate differences in HDL schlieren patterns between males and females are a function of the relative levels of these three components.

CYTOLOGY

8901 Cell shape and hexose transport in normal and virus-transformed cells in culture. Bissell, M.J.; Farson, D.; Tung, A.S.C. (Univ. of California, Berkeley). *J. Supramol. Struct.;* **6**: 1-12(1977).

The rate of hexose transport was compared in normal and virus-transformed cells on a monolayer and in suspension. It was shown that both trypsin-removed cells and those suspended for an additional day in methyl cellulose had decreased rates of transport and lower available water space when compared with cells on a monolayer. Thus, cell shape affects the overall rate of hexose transport, especially at higher sugar concentrations. Even in suspension, the initial transport rates remained higher in transformed cells with reference to normal cells. Scanning electron micrographs of normal and transformed chick cells revealed morphological differences only in the flat state. This indicates that the increased rate of hexose transport after transformation is not due to a difference in the shape of these cells on a monolayer.

8902 Electrophoretic analysis of brain proteins from young adult and aged mice. Vaughan, W.J.; Calvin, M. (Univ. of California, Berkeley). *Gerontology (Basel);* **23**: 110-126(1977).

The purpose of this study was to electrophoretically examine proteins from mice of different ages to determine whether general changes occurred in protein levels during senescence and to relate the data to specific ageing hypotheses involving proteins. Proteins from whole brain, brain regions, soluble and ribosomal brain frac-

tions, from young adult and senescent mice, were totally solubilized and subjected to polyacrylamide slab gel electrophoresis. The resulting gel patterns were then compared by examining the intensity of gel bands of the same migration distance. Positive controls were used to establish the high sensitivity of the electrophoretic method. For example, band intensity differences were observed when brain proteins from different species, different periods of growth and development, normal and mutant mice, and different brain regions were compared. Virtually all band intensities and, therefore, corresponding brain protein concentrations were unchanged when patterns from senescent mice were compared to patterns from younger adult mice. These results provide evidence against ageing hypotheses involving: (1) progressive programmed ageing; (2) protein cross-linking, and (3) a systematic shutdown of gene activity. The few, select, protein band changes that did occur provide evidence that (1) volume of the brain vascular system decreases with age, and (2) the brain S-100 protein concentration increases with age.

8903 Viration of deoxyribonucleic acid polymerase activities during avian erythropoiesis. Wang, H.F.; Popenoe, E.A. (Brookhaven National Lab., Upton. NY). *Biochim. Biophys. Acta;* **474**: 98-108(1977).

Amounts of DNA polymerase α and β were determined in extracts of chicken erythroid cells at various stages of development. Concentrations of both polymerase activities are high in erythroblasts which are still dividing, decline after the cells cease dividing and begin maturation, and become almost undetectable in the fully mature erythrocytes. While DNA polymerase α activity declines gradually, firmly bound DNA polymerase β activity in the nuclei drops abruptly after the cells finish DNA synthesis and dividing. The amount of a low molecular weight DNA polymerase extractable with the cytoplasmic fraction, possibly DNA polymerase β, is low in erythroblasts, increases in the more mature erythroid population and then declines to an undetectable level in the fully mature erythrocytes.

8904 Quantitative studies of the toxicity of benzo(a)pyrene to a mouse liver epithelial cell strain in culture. Landolph, J.R.; Bartholomew, J.C.; Calvin, M. (Univ. of California, Berkeley). *Cancer Res.;* **36**: 4143-4151(Nov 1976).

The toxic effects of the carcinogen benzo(a)pyrene (BaP) were studied in a well-characterized epithelial cell strain, NMuLi, derived from the livers of weanling Namru mice. These cells were extremely susceptible to the toxicity, 99% dying after a 6-day exposure to BaP, 5 μg/ml. The toxic effects began between 11 and 24 hr postapplication of BaP to the cells and increased exponentially with the time of treatment. The toxicity was concentration dependent in cells treated for a specific time period. The survival curves were exponential and extrapolated to a survival fraction of 1.0. The toxic effects of BaP to logarithmically growing NMuLi were inhibited 40% by 7, 8 benzoflavone, and the inhibition was concentration dependent. The 7, 8-benzoflavone also inhibited aryl hydrocarbon hydroxylase (AHH) from NMuLi cell homogenates and microsomes by 99%. The concentration dependence for AHH inhibition by 7, 8-benzoflavone paralleled its inhibition of cellular toxicity. The toxicity of BaP to these cells increased exponentially with the number of population doublings. Hence, the toxicity was 130 times greater in exponentially growing cells than in confluent cells. Levels of AHH, the enzyme that metabolizes BaP to its cytotoxic derivatives, were only 2.4 times higher in exponentially growing than in confluent cells, suggesting that cell division was responsible for the large differential toxicity. In addition, a toxic BaP metabolite was preferentially toxic to log-phase cells. The results indicate that the metabolism of BaP by AHH to produce cytotoxic metabolites, which may cause lesions that are expressed upon cell division, is reponsible for the cytotoxicity of BaP to NMuLi.

TRACER TECHNIQUES

8905 Hormonal regulation of cultured rabbit endometrial cells. Murai, J.T.; Conner, E.; Yang, J.; Andersson, M.; Berliner, J.; Gerschenson, L.E. (Univ. of California, Los Angeles). *J. Toxicol. Environ. Health;* **4**: No. 2-3, 449-456(1978).

A technique for culturing primary explants of rabbit endometrial cells in chemically defined medium has been developed. Diethylstilbestrol and natural estrogens were found to increase the rate of DNA initiation while progesterone had the opposite effect. Ultrastructural studies revealed that with estrogens, the cultures had the appearance of rapidly dividing cells having large euchromatic nuclei and prominent nucleoli, with abundant free ribosomes in the cytoplasm. On the other hand, progesterone induced the formation of large multinucleated cells and also converted the cells to a more secretory type. When the cultures appear secretory, a protein called blastokinin (uteroglobin) is believed secreted. We have found that cultured cells synthesize blastokinin and progesterone is necessary for its continuous synthesis. The cultures were found to have receptors for the ovarian hormones and these receptors exhibited saturation kinetics. The dissociation constants for the receptors were also determined. A hypothetical model for the hormonal regulation of cell proliferation and differentiation is proposed.

GENETICS

REFER ALSO TO CITATION(S) 8902

8906 Localization of the arginine tRNA gene to the D segment of T5 bacteriophage DNA. A new procedure for producing duplex DNA fragments. Desai, S.M.; Hunt, C.; Locker, J.; Weiss, S.B. (Univ. of Chicago). *J. Biol. Chem.;* **253**: No. 18, 6544-6550(25 Sep 1978).

Three of the four clusters are within the DNA C segment; the fourth cluster, to which only tRNA/sup Arg/ has been localized, maps in a 3.02 kilobase (kb) region of which 1.99 kb are at the right end of the C segment and 1.03 kb at the left end of the D segment. In order to localize the tRNA/sup Arg/ gene further and to define its relationship to the C-D nick, we devised a suitable method for preparing T5 DNA fragments whose ends correspond to the position of the T5 DNA nicks contained in the light DNA strand. In this method, DNA is denatured, partially renatured, and digested with low concentrations of S1 nuclease. Agarose-gel electrophoresis of these digests gives a pattern of bands which correlate in size with the pattern expected from the nicked structure of T5 DNA. Annealing of individual purified T5 [^{35}P]tRNA species to the T5 DNA fragments transferred to nitrocellulose filters shows that tRNA/sup Arg/ hybridizes exclusively to the D fragment and is therefore localized to 1.03 kb at the 5' (left) end of the heavy strand of the D segment. This finding suggests that the promotor for this early gene is to the right of the C-D nick in T5 DNA; hence, the C-D nick does not coincide with this early promotor.

8907 Incipient genome differentiation in gossypium. I. Chromosomes 14, 15, 16, 19, and 20 assessed in G. hirsutum, G. raimondii, and G. lobatum by means of seven A-D translocations. Menzel, M.Y. (Florida State Univ., Tallahassee); Brown, M.S.; Naqi, S. *Genetics;* **90**: No. 1, 133-149(Sep 1978).

The genus Gossypium is favorable for study of genome divergence at several levels. Early stages of divergence have been studied among four D genomes by comparing chiasma frequencies (reciprocal exchanges) between pairs of genomes and between individual counterpart chromosomes marked by heterozygous translocations. D_5 (G. raimondii) shows barely detectable differentiation from D/sub h/ (G. hirsutum), whereas D_7 (G. lobatum) is considerably less closely related to D/sub h/ than is D_5. Fragmentary data suggest that D/sub $_{2\text{-}2}$/ (G. harknessii) falls between D_5 and D_7 in its relationship to D/sub h/. Since chiasma frequencies in individual chromosomes and marked regions exhibit the same order of relationships as their corresponding whole genomes, it is concluded that the genome differentiation is generalized (i.e., nucleus-wide) rather than localized in specific chromosomes or chromosome regions. Estimates of relationships based on reciprocal exchange frequencies agree with those based upon preferential synapsis in allohexaploids reported previously. Since preferential synapsis and reciprocal exchange frequencies reveal the same order of relationships, it is concluded that to some extent they reflect common underlying changes in chromosome properties, despite recent evidence that synapsis and crossing over are under independent genetic control.

8908 Organization, function, and evolution of gene clusters in eucaryotes. Giles, N.H. (Univ. of Georgia, Athens). *Am. Nat.;* **112**: No. 986, 641-657(1978).

The occurrence and functional significance of gene clusters in procaryotes, such as Salmonella typhimurium and Escherichia coli, have become increasingly well documented since the classical studies of Demerec (1964) and Jacob and Monod (1961). Clearly, many clusters of bacterial genes having related functions constitute operons. Basically, a bacterial operon is a unit of genetic regulation under either negative or positive control (or both) which is transcribed as a polycistronic mRNA. The subsequent translation of such a mRNA serves to ensure the coordinate synthesis of the proteins (usually enzymes) encoded in a particular operon. In eucaryotes, gene clusters appear to be relatively less frequent than in procaryotes, although numerous such clusters have been detected in recent years. The present discussion will deal with examples of gene clusters based primarily on research with Neurospora crassa and will attempt to evaluate present evidence concerning the organization, function, and evolution of eucaryotic gene clusters in general.

METABOLISM

REFER ALSO TO CITATION(S) 8890

8909 (PNL-SA—6205) **Revised method of computing energy balances over vegetation canopies.** Droppo, J.G. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1977. Contract EY-76-C-06-1830. 4p. (CONF-780315—2). Dep. NTIS, PC A02/MF A01.

From 5. American Meteorological Society conference on fire and forest meteorology; Atlantic City, NJ, USA (14 Mar 1978).

The revised method does result in considerable reduction in the computed experimental error. The computed values using the standard and revised methods are within the experimental accuracy of each other, although this is largely a function of the large gradient inaccuracies. A better indication of the validity of the revised method is the reasonable ratios of eddy diffusivities implied by the results. A definitive test of this method will require comparison with direct flux measurements to determine the validity of Equation 3. This method, if proven valid, will provide a relatively inexpensive method of accurately monitoring and studying evaporative losses and other fluxes over uniform vegetation canopies.

8910 (TID—28671) **Mass spectrometric determination of nitrogen uptake by freshwater phytoplankton: the effect of chlorine and chloramine.** Pierce, J.M. (University of Southern Colorado, Pueblo (USA); Oklahoma State Univ., Stillwater (USA)). Dec 1976. Contract ET-76-S-03-1811. 149p. Dep. NTIS, PC A07/MF A01.

Thesis.

Using ^{15}N enrichment and quantitative mass spectrometry, this study investigated the uptake of nitrate and ammonia by the natural phytoplankton population of Lake Carl Blackwell. The Michaelis-Menten enzyme kinetic constants, V/sub max/ and K/sub s/, were calculated based on a linear least squares regression analysis of the uptake data. An error analysis was developed to determine the uncertainties of these constants. Simultaneous monitoring of irradiance, temperature, and ammonia concentration allowed correction of V/sub max/ and K/sub s/ for the effects of these parameters over an entire season. A one compartment model was built and used to correlate the effect of the above parameters with nitrate uptake. Experiments were performed to determine the effect of chlorine and chloramine on nitrate and ammonia uptake. Nitrate uptake was determined as a function of chlorine and chloramine concentrations both below and above the so called breakpoint stoichiometry. The perturbations of nitrate uptake by orthophosphate, pH, and germanium were also investigated. At low concentrations chloramine inhibited nitrate uptake to a greater extent than chlorine. The uptake rates of nitrate as a function of increasing concentrations of free and bound chlorine produced an equation which was not a continuously decreasing function. The surface, generated from this data, contained a relative minima and maxima due to the breakpoint reaction.

MEDICINE

REFER ALSO TO CITATION(S) 8368, 8948

8911 **Application of radiographic magnification technique with an ultra-high-speed rare-earth screen/film system to oral cholecystography.** Imhof, H.; Doi, K. (Univ. of Chicago). *Radiology;* **129**: No. 1, 173-178(Oct 1978).

2x magnification employing a 200-μ focal spot and an Alpha 8-XM screen/film system was applied to oral cholecystography and the results compared with those for the conventional contact technique with the Par-RP system. The basic imaging properties of the system, as well as phantom studies, indicated that the image quality obtained with magnification is comparable to or better than that for the conventional technique. In clinical studies on the detection of gallstones, the conventional technique revealed 5 true-positive and 17 true-negative cases and 1 false-positive and 2 false-negative cases, while the magnification technique provided 7 true-positive and 18 true-negative cases but no false cases. With the magnification technique the skin dose was reduced to approximately half that for the conventional contact technique.

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 8830

8912 **Ventilation patterns mimicking COPD in patients with diaphragmatic pacing for Ondine's curse.** Makhija, M.C.; Bronfman, H.J.; Lange, R.C.; Glenn, W.L.; Gottshalk, A. (Yale Univ., New Haven). *Radiology;* **129**: No. 1, 111-116(Oct 1978).

From 62. scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL, USA (14 Nov 1976).

Ventilation was studied with ^{133}Xe in 18 patients with central hypoventilation (Ondine's Curse) in whom diaphragmatic pacers were implanted. Three distinct patterns emerged: Type I, improvement in ventilation on the paced side (11 of 18 patients); Type II, improvement on both the paced and unpaced side (4 of 18); and Type III, no improvement (3 of 18). With the pacer off, many of these patients have patterns that mimic chronic obstructive pulmonary disease and that revert to normal with pacing. This retention, clearly reversible, cannot reflect permanent airways or airspace disease.

8913 **Basic principles of ROC analysis.** Metz, C.E. (Univ. of Chicago). *Semin. Nucl. Med.;* **8**: No. 4, 283-298(Oct 1978).

The limitations of diagnostic accuracy as a measure of decision performance require introduction of the concepts of the sensitivity and specificity of a diagnostic test. These measures and the related indices, true positive fraction and false positive fraction, are more meaningful than accuracy, yet do not provide a unique description of diagnostic performance because they depend on the arbitrary selection of a decision threshold. The receiver operating characteristic (ROC) curve is shown to be a simple yet complete empirical description of this decision threshold effect, indicating all possible combinations of the relative frequencies of the various kinds of correct and incorrect decisions. Practical experimental techniques for measuring ROC curves are described, and the issues of case selection and curve-fitting are discussed briefly. Possible generalizations of conventional ROC analysis to account for decision performance in complex diagnostic tasks are indicated. ROC analysis is shown to be related in a direct and natural way to cost/benefit analysis of diagnostic decision making. The concepts of average diagnostic cost and average net benefit are developed and used to identify the optimal compromise among various kinds of diagnostic error. Finally, the way in which ROC analysis can be employed to optimize diagnostic strategies is suggested.

8914 **Model for the radionuclide measurement of ascitic fluid volumes.** Kaplan, W.D.; Davis, M.A.; Uren, R.F.; Wisotsky, T.; LaTegola, M. (Harvard Medical School, Boston). *J. Nucl. Med.;* **19**: No. 10, 1138-1141(Oct 1978).

Technetium-99m phytate colloids formed in vitro and in vivo were examined as radioindicators for estimation of the volume of third-space fluid in an ovarian ascites model using C3HeB/FeJ mice. In double-label experiments, the accuracy of the colloids for dilution analysis was found to be equal or superior to that of I-125 HSA. Sampling times 3 to 5 min after intraperitoneal administration were found to produce the best volume estimates. Four needle-stopcock assemblies inserted sequentially into the quadrants of the peritoneal cavity were used for administration and sampling of the radioindicators. The stopcocks could be closed to prevent leakage of ascitic fluid during the procedure. In contrast to radiolabeled albumin, Tc-99m phytate colloids have clinical use for simultaneous imaging of radiotracer migration to assess potential occlusion of diaphragmatic lymphatics by neoplastic cells, and for dilution analysis to estimate volume of ascitic fluid.

MICROBIOLOGY

REFER ALSO TO CITATION(S) 7597

8915 (SAND—78-1237C) **Inactivation of enteric viruses in dewatered wastewater sludge.** Ward, R.L. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 23p. (CONF-780853—1). Dep. NTIS, PC A02/MF A01.

From Conference on design of municipal sludge compost facilities; Chicago, IL, USA (29 Aug 1978).

Several conclusions can be made from the results presented here. Dewatering by evaporation is an efficient method of inactivating enteric viruses in sludge. The rates of heat inactivation of enteric viruses are greatly modified by various components of sludge; heat inactivation of enteroviruses is accelerated by ammonia but retarded by detergents while reovirus inactivation is accelerated by detergents but slowed by an unidentified sludge component. The effects of these components are modified or enhanced in dewatered sludge. Composting of sludge appears to degrade or otherwise reduce the effects of these components.

PATHOLOGY

REFER ALSO TO CITATION(S) 8904

PHYSIOLOGICAL SYSTEMS

8916 **Measurement of mucociliary transport velocity in the intact mucosa.** Chopra, S.; Taplin, G.V.; Simmons, D.H.; Elam, D. (Univ. of California, Los Angeles). *Chest (Chicago);* **71**: 155-158(Feb 1977).

A new method for measuring the velocity of the tracheal mucous transport rate in anesthetized dogs is described. The length of the trachea is determined with the bronchoscope as the distance between the larynx and the lower end of the trachea at the level of the carina. A small volume (0.04 to 0.1 ml) of albumin microspheres 5μm to 7μm in diameter labeled with radioactive /sup 99m/technetium or /sup 113m/indium is deposited on the mucosal surface at the lower end of the trachea via a catheter placed in the inner channel of a fiberoptic bronchoscope. The movement of the microspheres towards the larynx is visualized and recorded using a scintillation camera (Picker Dyna Camera) with a large field of view (30 cm in diameter) for 30 to 60 minutes, depending upon the time required for the spheres to reach the top of the trachea. Polaroid pictures are made immediately and every minute thereafter until the activity reaches the larynx. The data are also recorded and stored on magnetic tape for subsequent analyses by computer. The length in millimeters divided by the time in minutes gives the transport velocity rate. The mean velocity was found to be 19.2 +- 1.6 mm/min (+-SE).

TRACER TECHNIQUES

REFER ALSO TO CITATION(S) 8905, 8916

AGRICULTURE AND FOOD TECHNOLOGY

REFER ALSO TO CITATION(S) 8368, 8376, 8381, 8382, 8383, 8384, 8385, 8386, 8387, 8388, 8389, 8390, 8391, 8431, 8944, 8945

BIOMEDICAL SCIENCES, APPLIED STUDIES

RADIATION EFFECTS ON BIOCHEMICALS

IN MICROORGANISMS

8917 Radiation-induced damage in T4 bacteriophage: the effect of superoxide radicals and molecular oxygen. Samuni, A.; Chevion, M.; Halpern, Y.S.; Ilan, Y.A.; Czapski, G. (Hebrew Univ., Jerusalem). *Radiat. Res.;* **75**: No. 3, 489-496(Sep 1978).

The sensitivity of T4 bacteriophage toward γ irradiation has been studied in phosphate buffer suspensions. The spectrum of the water radicals was controlled by a careful choice of the appropriate saturating gas and the addition of radical scavengers. Thus, it was possible to distinguish between the effects of molecular oxygen and the superoxide radicals formed through its reactions. About 90% of the damage was caused by the water radicals formed in the bulk suspensions. These probably affected the phage proteins; only the remainder of the damage involved the viral DNA. The oxygen enhancement ratio observed was not connected in any way with the formation of the superoxide radicals. The results confirmed that the OH radicals are the reactive species, while e/sub aq/$^-$ as well as the superoxide radical do not contribute to the radiodamage.

RADIATION EFFECTS ON CELLS

EXTERNAL SOURCE

REFER ALSO TO CITATION(S) 8923, 8924, 8925, 8926

8918 (CONF-770491—, pp 35) **Mammalian models of radiation carcinogenesis.** Marshall, J.H. (Argonne National Lab., IL). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

As an example of the kinds of models that can be developed to examine the mechanisms of radiation carcinogenesis, the details of a new three-dimensional model were described. The model relates radiation dose rate, tumor latency, and probability of osteosarcoma induction for ^{226}Ra-injected Beagle dogs and for human beings exposed to ^{226}Ra nd ^{226}Ra—^{228}Ra mixtures. Among the important variables that are taken into account in the model are cell killing and the rates of cell renewal in bone (bone turnover rate) in the two species.

8919 (CONF-770491—, pp 56-61) **Report of the panel on interactions of high-let radiation with cells.** Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

Some topics discussed are as follows: theories of radiation carcinogenesis; dose-response relationships for in vitro transformation of cells as a result of alpha-particle irradiation; mutagenesis; cytogenesis; and cytokinetics. (HLW)

8920 Hyperthermia and low dose-rate irradiation. Harisiadis, L.; Sung, D.I.; Kessaris, N.; Hall, E.J. (Columbia Univ., New York). *Radiology;* **129**: No. 1, 195-198(Oct 1978).

Hyperthermia combined with ^{60}Co gamma irradiation was studied using V79 hamster cells cultured in vitro. Modest hyperthermia (41°C for 6 hr) enhanced the cell killing produced by acute exposure to radiation. The same treatment enhanced the effect of low dose-rate irradiation (200 rads/hr) even more. The sequence in which modest hyperthermia was combined with low dose-rate irradiation was important. Maximal enhancement was observed when hyperthermia was followed by irradiations. The probable explanation is that, by damaging the repair system, prior heat renders the cells unable to repair sublethal damage during subsequent low dose-rate irradiation.

8921 Generalized formulation of dual radiation action. Kellerer, A.M.; Rossi, H.H. (Univ., Wuerzburg, Ger.). *Radiat. Res.;* **75**: No. 3, 471-488(Sep 1978).

Dual radiation action is a process in which cellular lesions are produced as a result of the interaction of pairs of sublesions that are molecular alterations produced by ionizing radiation. Previous formulations of this process have employed a number of simplifying assumptions that limit the accuracy and the range of application of theoretical analysis. The formulation presented here removes some of these restrictions by introducing three functions that describe the geometry of the sensitive material in the cell, the geometry of the pattern of energy deposition, and the interaction probability of sublesions as a function of their separation. The relation derived is similar to that obtained previously, in that lesion production is found to depend on two terms that are proportional to the first and the second power of the absorbed dose. However, the coefficients of these terms are now derived on the basis of a more realistic treatment.

8922 Cell survival as a function of depth for modulated negative pion beams. Raju, M.R.; Amols, H.I.; Bain, E.; Carpenter, S.G.; Cox, R.A.; Robertson, J.B. (Los Alamos Scientific Lab., NM). *Int. J. Radiat. Oncol., Biol. Phys.;* **4**: No. 9/10, 841-844(1978).

Cell survival measurements as a function of depth have been reported for three pion beams modulated in different ways. Cultured human cells (line T1) suspended in gelatin medium were used in this investigation. A uniform dose distribution in the peak region was found to produce more cell killing at the distal side of the peak compared to the proximal side. A uniform π^- stopping distribution in the peak region produced more cell killing at the proximal side of the peak compared to the distal side. These two distributions represent the extremes. The optimum dose distribution to obtain uniform biological effect in a broad pion peak region can be acquired by making the dose distribution nearly uniform from the proximal side of the peak to the peak center and then reducing the dose gradually from the peak center to the distal end of the peak. Cell killing in the peak region was more uniform for all three dose distributions when two opposing and overlapping fields were used. Dose distributions to produce uniform cell killing should be checked at higher doses because of the small rate of survival change in the shoulder region compared to the exponential region.

RADIATION EFFECTS ON MICROORGANISMS

BASIC STUDIES

REFER ALSO TO CITATION(S) 8917

8923 (BNL—24808) **uv photobiology: postreplication repair.** Sutherland, B.M. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 5p. (CONF-780856—2). Dep. NTIS, PC A02/MF A01.

From Synchrotron radiation applied to biophysical, biochemical and biomedical research; Frascati, Italy (20 Aug 1978).

The following topics are discussed: insertion of incorrect bases in DNA; ability of DNA polymerase to copy uv-irradiated DNA; role of enzymes in repair of DNA; effects of uv radiation on molecular weight of DNA; photoreactivation; repair of DNA in Escherichia coli and xp cells following uv radiation; and synchrotron radiation studies on DNA repair. (HLW)

8924 (BNL—24810) **uv photobiology: excision repair.** Sutherland, B.M. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 12p. (CONF-780856—3). Dep. NTIS, PC A02/MF A01.

From Synchrotron radiation applied to biophysical, biochemical and biomedical research; Frascati, Italy (20 Aug 1978).

The following topics are discussed: steps in nucleotide excision; damage to DNA by uv-endonuclease; use of complementation to study DNA repair in Escherichia coli and mammalian cells; role of BUDR photolysis in excision repair, relation between DNA repair defect and human disease; base excision repair; and excision repair by removal of damaged region of a base in DNA without excision. (HLW)

RADIATION EFFECTS ON PLANTS

BASIC STUDIES

8925 (BNL—24809) **uv photobiology: DNA damage and repair.** Sutherland, B.M. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 7p. (CONF-780856—1). Dep. NTIS, PC A02/MF A01.

From Synchrotron radiation applied to biophysical, biochemical and biomedical research; Frascati, Italy (20 Aug 1978).

The following topics are discussed: targets that determine the fate of the cell when uv light interacts with a cell; comparison of action spectrum for a given biological effect with the absorption spectrum of different biological macromolecules; biological effects of damage to DNA; measurement of mutations; chemical damage to DNA; photoreactivation; role of pyrimidine dimers in induction of skin cancer by uv. (HLW)

RADIATION EFFECTS ON ANIMALS

MAN

REFER ALSO TO CITATION(S) 8911

8926 (CONF-770491—, pp 31-35) **Effects of high let radiation at the cellular level.** Casarett, G.W. (Univ. of Rochester Medical School, NY). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The complete evaluation of the impact of nuclear energy technologies on human health requires: identification and characterization of hazardous agents and their effects, which is well advanced; quantitative dose-effect relations for important effects under various conditions of radiation exposure and biological variation, which needs more work but which has been advancing fairly well, particularly in experimental animal research; an understanding of the cellular and tissue mechanisms of the hazardous effects in relation to the microdosimetry of the agents, which has advanced slowly and to a relatively limited degree; and integration of the dose-effect relations and mechanistic knowledge into theories and models which are intended to be predictive for estimation of human health risks at pertinent low levels of exposure. Several theories, hypotheses or models of radiation carcinogenesis, and some for alpha radiation in particular, have been developed on the basis of dose-effect relations in the necessary attempt to predict the hazards of low levels of radiation exposure for purposes of radiation protection in advance of adequate data on dose-effect relations and mchanisms. As such these theories or models have necessarily involved strings of explicit and implicit assumptions concerning mechanisms and the nature of dose-effect relations below the dose regions at which effects have been observed. Nevertheless, they have been useful in stimulating research to test their assumptions and in assuming the interpretation of data.

8927 **Radiosensitivity of large human monocytes.** Kwan, D.K.; Norman, A. (Univ. of California, Los Angeles). *Radiat. Res.;* **75**: No. 3, 556-562(Sep 1978).

The in vitro survival of large human monocytes and the effect of ionizing radiation on the phagocytic function of these cells were determined 4 days following graded radiation doses. The monocyte survival curve was biphasic with a radiosensitive and a radioresistant population having D_0 values of 55 and 650 rad and including about 25 and 75% of the cells, respectively. With regard to function, the ability of large monocytes to phagocytize latex particles did not appear to be significantly affected by ionizing radiation within the dose range studied. Our results also indicate that monocytes are intrinsically more radioresistant than lymphocytes.

8928 **Scenarios of ^{14}C releases from the World Nuclear Power Industry from 1975 to 2020 and the estimated radiological impact.** Killough, G.G.; Till, J.E. *Nucl. Saf.;* **19**: No. 5, 602-622(1978).

This article presents an assessment of the radiation dose to the world population and the associated potential health effects from three scenarios of ^{14}C releases by the nuclear industry between 1975 and 2020. Measures of health impact are derived from source terms through the use of a multicompartment model of the global carbon cycle, dose-rate factors based on ^{14}C specific activity in various organs of man, and health-effect incidence factors recently recommended by the International Commission on Radiological Protection (ICRP). The three scenarios for worldwide ^{14}C releases considered are (1) a pessimistic scenario in which all the ^{14}C projected to be produced in fuel cycles is released (2) an optimistic scenario that assumes a decontamination factor of 100 for fuel reprocessing, and (3) an intermediate scenario that simulates a phased improvement in the effluent treatment technology at reprocessing plants. The estimates of cumulative potential health effects based on integration over infinite time (effectively 46,000 years or about 8 half-lives of ^{14}C) are as follows: 110,000 cancers and 75,000 genetic effects from the pessimistic scenario; 21,000 cancers and 14,000 genetic effects from the optimistic scenario; 22,000 cancers and 15,000 genetic effects from the intermediate scenario; 100,000 cancers and 68,000 genetic effects from the ^{14}C formed in nature between 1975 and 2020; and 380,000 cancers and 250,000 genetic effects from the ^{14}C formed by the detonation of nuclear explosives from 1945 to 1974. Comparable effects from the naturally formed ^{14}C in steady state in the environment, also integrated over 46,000 years, are approximately 66 million cancers and 43 million genetic effects. These estimates are based on a world population that is assumed to remain stationary at 12.2 billion after 2075.

PEST CONTROL

REFER ALSO TO CITATION(S) 8368

RADIONUCLIDE EFFECTS - INTERNAL SOURCE

MAN

REFER ALSO TO CITATION(S) 8872, 8918

8929 (CONF-770491—) **Workshop on research needs in actinide biology.** Durbin, P.W. (ed.). (Department of Energy, Washington, DC (USA). Office of Health and Environmental Research). Aug 1978. Contract W-7405-ENG-48. 109p. Dep. NTIS, PC A06/MF A01.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

Separate abstracts were prepared for the 14 papers presented at the conference. The following appendices are included: summary of actinide biological research; research in progress; general references; and workshop participants. (HLW)

8930 (CONF-770491—, pp 4-5) **Actinides: why are they important biologically.** Durbin, P.W. (Univ. of California, Berkeley). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed: actinide elements in energy systems; biological hazards of the actinides; radiation protection standards; and purposes of actinide biological research with regard to toxicity, metabolism, and therapeutic regimens. (HLW)

8931 (CONF-770491—, pp 6-9) **Research needs from three agency viewpoints.** Yaniv, S.S. (Nuclear Regulatory Commission, Washington, DC). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

Assessments of risk to the population and impact on the environment are performed as part of the licensing and standard setting process. Those assessments include evaluation of the effects of normal operation on the general population and occupationally exposed workers, consequences of potential adversary actions which may lead to damage of facilities and release of radionuclides into the environment. Generally, the data needed to perform realistic risk assessments include: knowledge of chemical and physical form of materials which may enter the environment; reliable models for predicting the physical transport, dispersion and deposition of materials in the environment confirmed by experiment and supported by their associated data base; methodology for reliably predicting cycling of radionuclides in ecological systems and the critical pathways whereby they may reach man; long-term environmental behavior and fate of radionuclides; chemical form and physiological availability of materials that may reach humans; bioaccumulation and retention of radioactive materials by human beings; dose conversion factors for inhaled and ingested materials; and dose-response relationships for the health effects of radionuclides ranging from long-term effects of low doses applied over long times to early mortality

and morbidity resulting from short-term inhalation or ingestion of relatively large amounts.

8932 (CONF-770491—, pp 9-15) **Research needs for setting environmental standards.** Ellett, W.C. (Environmental Protection Agency, Washington, DC). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed: risks to humans from ingestion or inhalation of actinides; transport of ingested actinides across the intestinal wall; tissue distribution of transuranics; dose to gonads from transuranics; genetic risks from alpha emitters; RBE for neutrons in gonadal tissues; use of cancer as endpoint for risk analysis; limits for gross alpha activity in drinking water; and high thorium levels in the vicinity of phosphate plants. (HLW)

8933 (CONF-770491—, pp 15-23) **Biological research and energy technologies.** Wachholz, B.W. (Energy Research and Development Administration, Washington, DC). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed: identification of environmental and health and safety considerations related to energy technologies; biomedical research associated with nuclear technologies; management of fissile, fertile, and waste radionuclides in various fuel cycle combinations; alpha emitters in reprocessing plant waste; agency interaction with the scientific and general community; response to research needs of the regulatory agencies; and interface with environmental programs. (HLW)

8934 (CONF-770491—, pp 24-27) **Inhaled actinides: some safety issues and some research problems.** Bair, W.J. (Battelle Pacific Northwest Lab., Richland, WA). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed: limited research funds; risk coefficients for inhaled particles; the hot particle hypothesis; the Gofman-Martell contention; critical tissues for inhaled actinides inhalation hazards associated with future nuclear fuel cycles; and approach to be used by the inhalation panel. (HLW)

8935 (CONF-770491—, pp 27-31) **Research needs in metabolism and dosimetry of the actinides.** Richmond, C.R. (Oak Ridge National Lab., TN). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed: uranium mine and mill tailings; environmental standards; recommendations of NCRP and ICRP; metabolic models and health effects; life-time exposures to actinides and other alpha emitters; high-specific-activity actinide isotopes versus naturally occurring isotopic mixtures of uranium isotopes; adequacy of the n factor; and metabolism and dosimetry; (HLW)

8936 (CONF-770491—, pp 36-39) **Actinide research to solve some practical problems.** Wrenn, M.E. (New York Univ.). Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed: generation of plutonium inventories by nuclear power plants; resettlement of the Marshallese Islanders into an actinide contaminated environment; high radiation background areas of the world; and radiation hazards to uranium miners. (HLW)

8937 (CONF-770491—, pp 40-50) **Report of the panel on inhaled actinides.** Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

Some topics discussed are as follows: assessment of risks to man of inhaling actinides; use of estimates for developing protection standards; epidemiology of lung cancer in exposed human populations; development of respiratory tract models; and effects in animals: dose- and effect-modifying factors. (HLW)

8938 (CONF-770491—, pp 50-56) **Report of the panel on problems in actinide metabolism and dosimetry.** Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

The following topics are discussed, absorption of actinide incorporated naturally into foods; bioaccumulation factors for actinides in terrestrial and aquatic pathways leading to man; estimation of actinide levels in domestic meat producing animals; autopsy and bioassay data; thorotrast studies; development of metabolic data for constructing accurate metabolic models; bone surface dosimetry studies; age related studies; protraction of high LET radiation; toxicity studies; compilation and critical analysis of actinide metabolic data; analysis of data for nuclear fuel cycle constituents; and chronic toxicity of actinides. (HLW)

8939 (CONF-770491—, pp 61-65) **Report of the panel on models of effects of high LET radiation on whole animals and man.** Aug 1978.

From Workshop on research needs in actinide biology; Seattle, WA, USA (5 Apr 1977).

In Workshop on research needs in actinide biology.

Human data are the most convincing data--even when their applicability may be considerably strained--and the acquisition and interpretation of such data deserves a high priority. This would include currently funded studies on plutonium workers, thorium workers, and uranium diffusion plant workers. It is obvious, however, that there is also need for information totally unavailable from human sources. Appropriate experimental animal studies must provide this information. These studies must be designed to permit the most credible extrapolation to man, and the development of such extrapolation techniques is as important as the conduct of the studies themselves. There was agreement that the results of toxicity experiments are almost never reported in a manner most useful to modelers and that this situation should be rectified by some means short of dictatorial edict: perhaps a manual of recommended practices, perhaps a "flying squad" of consulting epidemiologists, perhaps more frequent workshops involving the people who actually gather and report the data. Among the forbidden practices would be the expression of radiation dose in rem and the reporting of tumor incidence without individual animal data on time at risk. In the opinion of the panel, a delay in the implementation of plutonium recycle or the LMFBR increases, rather than decreases, the need for additional experimental data on pluonium toxicity. Without the delay there might be insufficient time for the acquisition and effective application of data from newly initiated research programs. But when the inevitability of plutonium as an energy source is acknowledged--5, 10, or 20 years hence--we will be severely and justifiably criticized if we have not used this period to acquire a better understanding of the health effects of plutonium.

8940 **Radium-induced malignant tumors of the mastoid and paranasal sinuses.** Littman, M.S. (Argonne National Lab., IL); Kirsh, I.E.; Keane, A.T. *Am. J. Roentgenol.;* **131**: No. 5, 773-785(Nov 1978).

In the records of 5,058 persons with therapeutic or occupational exposure to radium, 21 patients with carcinoma of the mastoid and 11 with malignant tumors of the paranasal sinuses were identified. Tumor induction times were 21 to 50 years for mastoid tumors (median, 33) and 19 to 52 years for paranasal sinus tumors (median, 34). Dosimetric data are given for the patients whose body burdens of radium have been measured. We found a high proportion of mucoepidermoid carcinoma, comprising 38% of the mastoid and 36% of the paranasal sinus tumors. Three patients had antecedent bone sarcoma at 20, 11, and 5 years, respectively, and a bone sarcoma was discovered at autopsy in a fourth patient. Radiographic changes in the mastoid and paranasal sinuses were similar to those seen in nonradium malignant tumors. More than 800 known persons exposed to radium before 1930 and another group of unknown size who received radium water or injections of radium from physicians are still alive and at risk of developing malignant tumors of the mastoid and paranasal sinuses.

ANIMALS

REFER ALSO TO CITATION(S) 8918, 8939

8941 (BNL—24795) **Forced differentiation of CFU-s by iron-55 erythrocytocide.** Reincke, U.; Brookoff, D.; Burlington, H.; Cronkite, E.P. (Brookhaven National Lab., Upton, NY (USA); Mount Sinai School of Medicine, New York (USA)). 1978. Contract EY-76-C-02-0016. 97p. (CONF-7806105—3). Dep. NTIS, PC A05/MF A01.

From Hemopoietic stem cell symposium; Upton, NY, USA (12 Jun 1978).

Cascades of Auger electrons are emitted in the decay of ^{55}Fe and absorbed in tissue within a 1 μm radius. Cytocidal amounts of ^{55}Fe can therefore eliminate erythroid precursors with minimal damage to adjacent cells. Early events leave the granuloid series undisturbed but they are accompanied by a precipitous fall of pluripotent stem cells levels (CFU-s) in bone marrow, spleen, and blood. The pretreatment levels of CFU-s are not restored. Gradual decline of CFU-s is associated with intermittently increased turnover rate and reduced settings of cell production, yet unimpaired capacity for quick restoration of blood loss. The precipitous initial stem cell decrease is not caused by irradiation damage as shown in a separate experimental series which uses the frozen-storage cytocide technique. Only over several weeks could ^{55}Fe radiation accumulate to

lethal levels in nondividing stem cells. This irradiation is attributed to incorporation of small amounts of ^{55}Fe into CFU-s from where it is slowly cleared. The stem cell loss immediately following ^{55}Fe injection is in our interpretation caused by rapid differentiation along the erythroid pathway in a response that involves all progenitor populations. Data are consistent with the hypothesis of limited cell renewal capacity which thereby gains further support.

NUCLIDE KINETICS AND TOXICOLOGY

MAN

REFER ALSO TO CITATION(S) 8932, 8940

ANIMALS

8942 Age and dosage-level dependence of radium retention in beagles. Parks, N.J.; Pool, R.R.; Williams, J.R.; Wolf, H.G. (Univ. of California, Davis). *Radiat. Res.;* **75**: No. 3, 617-632(Sep 1978).

Radium retention was measured over the lifespan of 46 beagles exposed by eight semimonthly injections at 60 to 160, 120 to 220, or 435 to 535 days of age. Injection dosage levels ranged from 0.37 to 10 μCi of ^{226}Ra/kg. The fractional retention of each animal is described in terms of a modified power function, $R = [(t + d)/d]^{-}$/ sup b/. Young adult beagles (approximately equal to 10 kg) injected at a mean age (A) of 485 days with ^{226}Ra at dosage levels of 10, 3.3, 1.11, and 0.37 μCi/kg had mean values for d and b of [0.897; 0.187], [2.015; 0.206], [2.778; 0.257], and [3.894; 0.274], respectively. Juvenile beagles injected with 10 μCi/kg at A = 110 days (average weight approximately equal to 6 kg) and at A = 170 days (average weight approximately equal to 10 kg) had mean values for d and b of [137; 0.277] and [5.53; 0.086], respectively. The d values are geometric means and the units are days; b values are arithmetic means. The formula for deriving the age-dependent retention function for dogs is given. The beagle results were correlated with human data in terms of age-to-equivalent fraction of adult body calcium content and were used to construct a similar age-dependent retention function for chronically exposed people. The correlation of age-dependent retention functions for beagles and humans is used to estimate scaling factors between the two species for the fraction of injected dosage associated with bone for various ages of exposure.

8943 Plutonium retention, excretion, and distribution in juvenile beagles soon after injection. Lloyd, R.D.; McFarland, S.S.; Atherton, D.R.; Mays, C.W. (Univ. of Utah, Salt Lake City). *Radiat. Res.;* **75**: No. 3, 633-641(Sep 1978).

Six beagles, aged 3 months, were injected intravenously with 0.4 μCi of ^{239}Pu + 0.4 μCi of ^{237}Pu as the citrate complex. Retention in liver and in nonliver tissue (mainly skeleton) was measured serially in the living dogs by a combination of total- and partial-body counting, utilizing the 60- and 100-keV photons from ^{237}Pu. About 11% of the injected Pu was excreted in the first 21 days with about 5% in urine and 6% in feces. One animal was sacrificed at 7 days, another at 14 days, and the remaining dogs at 28, 56, 89, and 119 days after injection for distribution studies. Early retention of Pu in liver was lower in juveniles (11 to 15%) than observed previously in adults aged 17 months (31 to 37%), while early skeletal retention was greater for juveniles (62 to 75%) than for adults (50 to 60%). Plutonium content of most other tissues was similar in adults and juveniles. The distribution of skeletal Pu was significantly greater for juveniles in the paws and lower leg bones by factors of 2 to 5, but greater for adults by about a factor of 2 in the thoracic and lumbar vertebrae and in the rib cage.

MICROORGANISMS

REFER ALSO TO CITATION(S) 8891

CELLS

REFER ALSO TO CITATION(S) 8920

CHEMICALS METABOLISM AND TOXICITY

REFER ALSO TO CITATION(S) 7737

MICROORGANISMS

REFER ALSO TO CITATION(S) 8386

PLANTS

REFER ALSO TO CITATION(S) 8386, 8387, 8389, 8390, 8866

8944 Excess trace metal effects on cotton. V. Nickel and cadmium in solution culture. Rehab, F.I.; Wallace, A. (Univ. of Helwan, Alexandria, Egypt). *Commun. Soil Sci. Plant Anal.;* **9**: No. 8, 771-778(1978).

Two cultivars of cotton (Gossypium spp.) were grown in solution culture in a glasshouse to determine phytotoxicity effects of excesses of Ni and Cd. Leaf yield was depressed 94% by 10^{-4}M $NiSO_4$ (with 198μg Ni/g leaf) in Acala SJ-2 and 93% (with 167μg Ni/g) in Pima PS-5. The Ni gradient was roots > stems > leaves in both cultivars. At 10^{-5}M, $CdSO_4$ gave more phytotoxicity than $NiSO_4$. The 10^{-4}M $CdSO_4$ resulted in about the same amount of phytotoxicity as did the Ni for both cultivars. The Pima PS-5 plant parts, however, contained less Cd than did the Acala SJ-2 at the highest Cd concentration. At 10^{-5}M $CdSO_4$ the reverse held in leaves and stems. Interactions held for both metals but the inverse effect between Cd and Mn was less pronounced than for other species. Many other interactions were present.

8945 Excess trace metal effects on cotton. VI. Nickel and cadmium in Yolo loam soil. Rehab, F.I.; Wallace, A. (Univ. of Helwan, Alexandria, Egypt). *Commun. Soil Sci. Plant Anal.;* **9**: No. 8, 779-784(1978).

Two cultivars of cotton (Gossypium spp.) were grown in Yolo loam soil in a glasshouse to determine phytotoxicity effects of excesses of Ni and Cd. A 200 μg/g level of Ni in soil reduced yield by 60% in Acala SJ-2 and by 83% in Giza 45. The leaf Ni concentrations, respectively, were 146 and 165 μg/g. The 300 μg/g level of Cd decreased leaf yields by 60% and 75% for the two cultivars, respectively. Leaf concentrations of Cd, respectively, were 43 and 63 μg/g. There was a stem to leaf gradient of Cd for all cases. High Cd did not depress Mn concentrations in plants as in other species but there were many mineral element interactions.

VERTEBRATES

8946 (CONF-771175—, pp 8.3.1-8.3.3) **Biological effects of methanol spills into marine, estuarine, and freshwater habitats.** D'Elisou, P.N. (Univ. of Santa Clara, CA). Jul 1978.

From Symposium on alcohol fuel technology; Wolfsburg, F.R. Germany (21 Nov 1977).

In Proceedings of the international symposium on alcohol fuel technology: methanol and ethanol.

The biological impact of methanol spills into aquatic systems is moderated by several factors. Methanol is removed quickly from aquatic habitats by both biological and physical processes. Low initial impact probabilities, in comparison to existing fuels, suggest minimal large habitat consequences from moderate spill situations. Environmental methanol effects are correlated with differential organismic tolerance levels, ciliary narcosis, behavioral disruptions, untimely autotomy, cardiac arrhythmia, premature molting, and reduction of parasite resistance. However, gasoline and related fuels are much more toxic, and lead to more irreversible effects than methanol in comparable concentrations.

8947 Induction of ovalbumin synthesis in immature chicks by actinomycin D and thioacetamide. Sharma, O.K. (Univ. of Colorado, Lakewood). *Science;* **202**: 68-69(6 Oct 1978).

Actinomycin D and thioacetamide induced ovalbumin synthesis and increased serum progesterone concentrations in immature chicks. The increase in progesterone induced by the carcinogens actinomycin D and thioacetamide may account for the induction of ovalbumin synthesis.

MAN

REFER ALSO TO CITATION(S) 7271, 7621, 7622, 8856

8948 Cytogenetic effects of contrast media and triiodobenzoic acid derivatives in human lymphocytes. Norman, A.; Adams, F.H.; Riley, R.F. (Univ. of California, Los Angeles). *Radiology;* **129**: No. 1, 199-203(Oct 1978).

From 63. scientific assembly and annual meeting of the radiological society of North America; Chicago, IL, USA (27 Nov 1977).

Micronuclei counts in blood samples from 9 patients before and after angiocardiography have confirmed previous results suggesting the diatrizoate contrast medium was largely responsible for the observed cytogenetic damage. To discover the agents in the medium causing the cytogenetic damage, we exposed human lymphocyte cultures to diatrizoate and to the monoamino- and diamino-derivatives of triiodobenzoic acid. The results show the amino-derivatives are capable of inhibiting mitosis and inducing micronuclei and chromosome aberrations at lower concentrations than diatrizoate.

OTHER ENVIRONMENTAL POLLUTANT EFFECTS

8949 (SAND—78-1571) **Magnitude and range dependence of laser radar signals retroreflected from topographic targets.** Hargis, P.J. Jr.; Hohimer, J.P.; Hughes, R.L. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 84p. Dep. NTIS, PC A05/MF A01.

A coaxial Nd : YAG radar which could operate at wavelengths of 1.064 μm and 0.532 μm was used to measure the magnitude and range dependence of laser radar signals retroreflected from a wide variety of topographic targets. Measurements were made at three target ranges for all of the targets and at six target ranges for two selected targets. The range dependence of the 1.064 μm data could only be explained by the addition of a very small specular retroreflection to the backscattered signals. The measured specular reflectivity at 1.064 μm varied from 8×10^{-9} to 3×10^{-7}. No specular reflectivity could be inferred from the 0.532 μm data measured at only three target ranges. The measurements made at six target ranges indicate that the specular reflectivity at 0.532 μm may be as much as two orders of magnitude larger than that at 1.064 μm. The diffuse bidirectional reflectance in the backscatter direction varied from 0.029 sr^{-1} to 0.28 sr^{-1} at 1.064 μm and from 0.26 sr^{-1} to 17 sr^{-1} at 0.532 μm. The diffuse reflectivity at 0.532 μm was larger than that at 1.064 μm for every target investigated. The values measured for the specular and diffuse reflectivities lead to large specular signal enhancements when a downward looking laser radar at satellite altitudes is used to detect the component of laser radiation retroreflected by the earth's surface.

HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 8366, 8367

GEOSCIENCES

REFER ALSO TO CITATION(S) 7881

GEOLOGY AND HYDROLOGY

REFER ALSO TO CITATION(S) 7372

GEOPHYSICS

SEISMOLOGY AND TECTONICS

REFER ALSO TO CITATION(S) 7293, 8958

8950 **Seismissions and surface waves related to geologic structures.** Frantti, G.E. (Michigan Technological Univ., Houghton). pp 271-289 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Underground and surface field studies in the western Upper Peninsula of Michigan reveal low frequency seismic signals and effects attributed to geologic structures. Narrow-band signals centered about 9 to 10 hz., 30 to 40 hz., and 80 to 150 hz. appear to be related to adjustments in local geologic structure during the development of an underground copper mine in a tabular ore body contained in interbedded shales and sandstones. Cumulative activity rates of the 30 to 40 hz. and 80 to 150 hz. signals increase considerably before major rockfalls. Surface waves in a 0.5 to 10 hz. band which have propagated 90 to 150 km from large commercial blasts appear to intensely deteriorate within an incremental distance of a few kilometers when their travel paths are interrupted by elongated underground excavations. These studies suggest that important diagnostic seismic effects contained in a 0.5 to 100 hz. band can be used in connection with underground mines (1) to monitor the stability of surrounding geologic structures and (2) to delineate areas of impending or potential subsidence.

8951 (SAND—78-0497) **Estimation of transient measurement errors.** Bickle, L.W.; Keltner, N.R. (Bickle (Larry W.) and Associates, Albuquerque, NM (USA); Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EY-76-C-04-0789. 175p. Dep. NTIS, PC A08/MF A01.

Accurate interpretation of data from transient experiments requires a thorough understanding of the transient response characteristic of the measurement system. In many cases, the response characteristic depends not only upon the sensor but also upon the method of mounting and the signal conditioning/recording equipment. In all transient experiments, the measurement system distorts the signal to some extent; the problem is to estimate the amount of distortion and to determine if this is acceptable. This report shows how a time-domain convolution technique which uses the response of the system to a unit-step input as the characteristic response function can be used to estimate errors in rise time, peak amplitude, pulse width, etc., for arbitrary transient inputs. First, the use of the time-domain convolution technique to estimate the response of a system to arbitrary transient inputs is summarized. Basic concepts needed to use the idealized response plots effectively are presented. Some systems can be approximated by one of the classic first- or second order response models; separate chapters treat low-pass first-order systems, high-pass first-order systems, low-pass second-order systems, and high-pass second-order systems. Each of these four self-contained chapters describes how frequency-response information can be converted to the required time-domain information, presents plots for rapid bounding of errors, collects responses to idealized inputs, and presents example applications. The time-domain techniques are not limited to idealized systems that obey classic first- or second-order ordinary differential equations and are not restricted to using solely the unit step response. Such systems are addressed in the later chapters. 168 figures, 4 tables, 23 references. (RWR)

8952 **Amplitudes and spectra from underground sources.** Greenfield, R.J. (Pennsylvania State Univ., University Park). pp 405-425 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

The signals generated by various types of sources in infinite elastic media will be described with emphasis on features of the radiation patterns which can differentiate between different types of microfracturing mechanisms. Relationships between the fracture size and signal spectra will be discussed. Modification of the signal during propagation by anelastic attenuation will be described in both the time and frequency domain. It will also be demonstrated that layering of the material between the source and the receiver can greatly affect the amplitude of the received signal. The existence of a void or opening in the vicinity of a seismic source will modify the radiated signal. To study this effect expressions were developed for the seismic wave fields from sources on the surface of a cylindrical opening. The expressions were employed to demonstrate the way in which the signal is modified by the presence of the opening. The frequency domain effects on the radiated compressional and shear waves will be shown. The presence of the opening is shown to effect wavelengths shorter than approximately 15 cavity radii.

MINERALOGY, PETROLOGY, AND ROCK MECHANICS

REFER ALSO TO CITATION(S) 7398, 7426, 8950

8953 **Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials.** Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977). 495p. (CONF-7506131—). Trans Tech Publications, 16 Bear Skin Neck, Rockport, MA 01966, $40.00.

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

The 25 papers deal with laboratory, field, and analytical aspects of acoustic emission/microseismic activity in the areas of mining, petroleum, and civil engineering and in geology and geophysics. Abstracts were prepared for selected papers. (JSR)

8954 **Acoustic emission and fatigue mechanism in rock.** Haimson, B.C.; Kim, K. (Univ. of Wisconsin, Madison). pp 35-55 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Cumulative and noise rate acoustic emission recordings were made during monotonic and cyclic loading of hard rocks in uniaxial and triaxial compression, tension and tension-compression. Two types of fatigue mechanism can be identified from the noise records. One is represented by Westerly granite and appears to involve gradual stable microcracking, culminating in coalescence, macrofracturing and failure. The other is represented by Pink Tennessee marble, which fails without a warning, following a sudden unstable growth of an initial weak discontinuity. In tension-compression the accelerated fatigue failure is clearly recognized through acoustic emission. In general, the accumulated microseismic activity can be correlated to strain-time behavior during cycling. However, since acoustic emission in most rocks appears to be significantly more sensitive to imminent failure it could possibly be used to advantage in some practical applications.

8955 Study of acoustic emission during laboratory fatigue tests on Tennessee sandstone. Khair, A.W. (Pennsylvania State Univ., University Park). pp 57-86 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

In these studies cylindrical specimens of Tennessee Sandstone were cyclically loaded under uniaxial compressive stress. A triangular loading cycle (frequency 0.25 Hz for most tests) was applied using an MTS electrohydraulic loading system. Fatigue characteristics of the test material were studied by carrying out a series of tests at different maximum stress levels. Examination of stress-strain-time data indicated the presence of creep which changes character as the number of cycles increase. The acoustic emission pattern for subsequent cycles appeared approximately similar; however, it was interesting to note that the peak acoustic emission rate was not coincident with the peak stress. Observation of a large number of cycles indicated a slowly varying (modulated) acoustic emission pattern. Besides the cyclic tests a number of specimens were loaded directly to failure at a constant rate of loading. Here the acoustic emission rate was found to correlate well with the observed deformation, and the peak acoustic emission rate was found to occur at a stress level near, but somewhat lower, than the failure stress.

8956 Acoustic emission during fluid injection into rock. Byerlee, J.D.; Lockner, D. (Geological Survey, Menlo Park, CA). pp 87-98 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

The source locations of acoustic emission events were determined during the injection of water into a sample of Weber sandstone subjected to constant confining pressure and differential stress. For the first 10,000 minutes, the shocks were randomly distributed throughout the sample. During the next 460 minutes, they originated at the end of the sample where the water was being injected. Failure then occurred rapidly, and the fracture front advanced through the sample as water flowed through the fractured material of increased permeability, maintaining a low effective stress at the fracture front. It is notable that the most intense activity occurred at the fracture front, and once the fracture front passed a region, the acoustic emission decreased even though the differential stress was maintained at a constant value and the pore pressure in that region increased as water flowed into the sample.

8957 Acoustic emission and fault formation in rocks. Lockner, D.; Byerlee, J. (Geological Survey, Menlo Park, CA). pp 99-107 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Acoustic emission events were recorded during failure of sandstone and granite samples that were deformed under a confining pressure of 1 kb. At a differential stress higher than about 90 percent of the ultimate strength of one of the sandstone samples, the hypocenters of the events tended to cluster on a plane that coincided with what eventually became the fault plane. During another experiment in which a sample of sandstone was deformed at a much slower rate, clustering of the events on the fault plane occurred only in the post-failure region. In both the experiments that were carried out with granite, there was no tendency for the acoustic emission events to cluster on the fault plane before the ultimate strength of the rock was reached. Malfunction of our data collection system during violent failure of the granite samples prevented us from determining whether or not clustering of the events occurred in the post-failure region with granite.

8958 Acoustic emissions in rock stressed to failure. Rothman, R.L. (Air Force Technical Applications Center, Alexandria, VA). pp 109-133 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

The fact that the porosity of rock specimens increases prior to failure has been known for sometime. To further study these changes in porosity due to cracking in the rock specimen, a series of laboratory experiments were conducted. The principal objective was to investigate the nature of the cracks developed as dilatancy occurred and to determine their orientation relative to the final faulting. Another objective was to investigate the variation of P wave velocities with respect to direction of propagation and applied load.

8959 Design, installation, and operation of computer controlled rock burst monitoring systems. Blake, W. (Consulting Mining Engineer, Hayden Lake, ID). pp 157-167 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Microseismic techniques for monitoring rock-burst prone mine structures are being accepted by the mining industry. The installation and operation of automatic computer controlled rock burst monitoring, RBM, systems are now realities, but the versatility of such systems must be increased and expanded to allow more of the data analysis to be performed on-line by the computer. Basic guidelines for selecting the components of a computer controlled RBM are presented. Installation procedures are described to emphasize the importance of the initial installation. The operation of the RBM, including on-site data analysis, is discussed to show the importance and need for having the capability to instantaneously update and evaluate new RBM data.

8960 Experiences with AE-measurements in Boliden mines. Krauland, N.; Westerberg, K. (Boliden Aktiebolag, Sweden). pp 195-203 of Proceedings of the first conference on acoustic emission/microseismic activity in geologic structures and materials. Hardy, H.R. Jr.; Leighton, F.W. (eds.). Clausthal, Ger.; Trans Tech Publications (1977).

From Conference on acoustic emission (microseismic activity) in geologic structures and materials; University Park, PA, USA (9 Jun 1975).

Swedish experiences in the development and use of acoustic emission to monitor potential rock burst are outlined, including equipment design, field experiments, and data interpretation. The criteria to be used in the design of a rock burst monitoring system are tabulated. (JSR)

OCEANOGRAPHY

REFER ALSO TO CITATION(S) 8853

8961 Effects of a coastal front on the distribution of chlorophyll in Lake Tahoe, California-Nevada. Leigh-Abbott, M.R.; Coil, J.A.; Powell, T.M.; Richerson, P.J. (Division of Environmental Studies, University of California, Davis, California 95616). *J. Geophys. Res.;* **83**: No. C9, 4668-4672(20 Sep 1978).

The existence of a distinct coastal zone is confirmed in Lake Tahoe (California-Nevada) by horizontal transects measuring chlorophyll and temperature simultaneously. Creation of the coastal region is influenced by bottom topography, the nature of the surface wind stress, and the difference between physical processes occuring within a Rossby radius of deformation and those occurring in midlake. Chlorophyll records from horizontal transects were decomposed by spectral analysis, and the normalized spectra from nearshore and midlake were compared. The two regions were found to differ at large scales, primarily because of differences in nutrient import, and at intermediate scales because of differences in the mixing regime. The coastal zone was observed to erode with increasing winds and weakening stratification, leading to little significant difference between nearshore and midlake chlorophyll patterns.

PHYSICS RESEARCH

ASTROPHYSICS AND COSMOLOGY

SOLAR PHENOMENA

8962 Power spectrum of the solar wind speed for periods greater than 10 days. Fenimore, E.E.; Asbridge, J.R.; Bame, S.J.; Feldman, W.C.; Gosling, J.T. (University of California, Los Alamos Scientific Laboratory Los Alamos, New Mexico 87545). *J. Geophys. Res.;* **83**: No. A9, 4353-4358(1 Sep 1978).

The LASL experiments on the Vela 2-6 and Imp 6-8 satellites have provided more than 11 years of solar wind speed data. The length of this data set provides sufficient frequency resolution to study in detail the power spectrum of speed variations in the range near the solar rotational frequency. Year-by-year power spectra show such large differences that the solar wind time series is probably nonstationary. The spectrum of the entire 11-year time series shows broad bands of power near periods of 27 days (corresponding to the rotational period of the sun), 13.5 days, and higher harmonics. The band of power near 27 days extends from about 25 to about 31.5 days and contains a number of sharply defined peaks. Similar groups of peaks near a period of 27 days in a highly correlated time series, the geomagnetic index aa, have been explained as a solar latitude effect caused by differential rotation. However, recent observations indicate that the source regions of the solar wind during this last solar cycle did not participate in differential rotation; that is, there was a preferred range of longitudes for the sources. We suggest that the individual peaks in both the solar wind and the geomagnetic spectra are probably not due to differential rotation, although the band of power near 27 days almost certainly reflects solar rotation. Rather, the multipeak nature of the power spectra can be explained by a wave packet concept in which recurring high-speed streams are described as a series of pulses (separated by a constant period) that last for a varying number of solar rotations. Subsequent wave packets have the same period but are shifted in phase to mimic the range of possible longitudes for sources of solar wind streams. Power spectra obtained for such idealized wave packets closely resemble the measured spectra of the solar wind speed and geomagnetic activity. We do not find the frequencies predicted by a theory concerning the nonradial oscillation of the sun.

COSMOLOGY

REFER ALSO TO CITATION(S) 9049

8963 Condensation of photons in the hot universe and longitudinal relict radiation. Kuz'min, V.A.; Shaposhnikov, M.E. (Institute of Nuclear Research, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 11, 628-631(5 Jun 1978).

Assuming that the photon mass differs from zero, a hypothesis is advanced that a photon condensate existed in the universe at earlier expansion stages. The evaporation of the condensate as a result of interaction with charged particles has led to the formation of longitudinal relict radiation that constitutes possibly the bulk of the mass of the universe.

PLANETARY PHENOMENA

8964 Sources of magnetic fields in recurrent interplanetary streams. Burlaga, L.F.; Behannon, K.W.; Hansen, S.F.; Pneuman, G.W.; Feldman, W.C. (NASA/Goddard Space Flight Center, Laboratory for Extraterrestrial Physics, Greenbelt, Maryland 20771). *J. Geophys. Res.;* **83**: No. A9, 4177-4185(1 Sep 1978).

We examined the sources of magnetic fields in recurrent streams observed by the Imp 8 and Heos spacecraft at 1 AU and by Mariner 10 en route to Mercury between October 31, 1972, and February 9, 1974, during Carrington rotations 1607-1610. Most fields and plasmas at 1 AU were related to coronal holes, and the magnetic field lines were open in those holes. However, some of the magnetic fields and plasmas at 1 AU were related to open field line regions on the sun which were not associated with known coronal holes, indicating that open field lines may be more basic than coronal holes as sources of the solar wind. Magnetic field intensities in five equatorial coronal holes, estimated by projecting the measured interplanetary magnetic fields back to the sun by using the principle of flux conservation ranged from 2 to 18 G with an average of 9 G. Average measured photospheric magnetic fields along the footprints of the corresponding unipolar fields on circular equatorial arcs at 2.5 R/sub s/ had a similar range and average, but in two cases the intensities were approximately 3 times higher than the projected intensities. The coronal footprints of the sector boundaries on the source surface at 2.5 R/sub s/, determined by a potential field extrapolation of the measured photospheric fields, meandered between -45° and +45° latitude, and their inclination with respect to the solar equator ranged from near 0° at some longitudes to near 90° at others. It is possible that sector boundaries are related to convergence surfaces of the flow near the sun. The high densities observed near sector boundaries between streams might be due in part to the convergence of flows from adjacent coronal holes.

ATMOSPHERIC PHYSICS

8965 Possible variations in atmospheric ozone related to the eleven-year solar cycle. Penner, J.E.; Chang, J.S. (Lawrence Livermore Laboratory, University of California, Livermore, CA 94550). *Geophys. Res. Lett.;* **5**: No. 10, 817-820(Oct 1978).

Changes in ozone, temperature, and other minor constituents resulting from eleven-year variations in the solar flux between 180 and 340 nm are presented. Results were computed using a one-dimensional time dependent model that allows for all major feedbacks and time delays which may result from changing photolysis rates in the O/sub x/-NO/sub x/ -HO/sub x/-ClO/sub x/ system.Since the 1950's the chlorine content of the stratosphere has been increasing. The effect of this increase on ozone variability during the last two solar cycles is analyzed. Expected variations in O_3 and temperature resulting from changes in the uv flux are compared to available measurements.

MAGNETOSPHERIC PHENOMENA

8966 IMP 6 measurements in the distant polar cusp during substorms. Fairfield, D.H.; Hones, E.W. Jr. (Planetary Magnetospheres Branch, NASA/Goddard Space Flight Center). *J. Geophys. Res.;* **83**: No. A9, 4273-4288(1 Sep 1978).

The IMP 6 spacecraft was able to make measurements in the distant dayside cusp during substorms when the cusp was located slightly equatorward of its normal location and the geomagnetic dipole was tilted in the appropriate direction. High time resolution data from the magnetic field, plasma, energetic particle, and VLF wave experiments yield support for both reconnection and diffusion as methods of particle entry to the magnetosphere. The support for reconnection is indirect evidence from particles which flow down cusp field lines near the noon meridian. This evidence (1) indicates an acceleration process to explain enhancements of 400 to 600-km/s protons above their magnetosheath intensities and (2) suggests convection of field lines over the polar cap as a means of explaining the lack of low-energy protons near the low-latitude boundary of the cusp. Support for diffusion comes from indications of turbulent flows and fluctuating magnetic fields near the outer boundary of the entry layer. Magnetic field fluctuations below the proton gyrofrequency increase at larger radial distances and higher latitudes within the cusp. Perturbation vector ΔB is perpendicular to B in the lower β plasma at lower altitudes but is more randomly oriented in the higher β plasmas of the distant cusp. Ion cylotron waves are frequently seen in the entry layer and outer cusp. An abrupt change in the intensity of both whistler waves and electrostatic waves near half-integral multiples of the electron gyrofrequency seems to be characteristic of the outer boundary of the cusp. This boundary does not seem to be a standing shock.

ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS

8967 Contribution of the exciton—photon interaction to the exciton absorption line shape in the spatially inhomogeneous wave model: Application to the a-singlet exciton of naphthalene. Robinette, S.L.; Stevenson, S.H.; Small, G.J. (Ames Laboratory USDOE and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *J. Chem. Phys.;* **69**: No. 12, 5231-5239(15 Dec 1978).

The problem of determining the contribution of the exciton—photon coupling to the absorption line shape or width of an exciton is addressed. In this regard, both the spatially homogeneous (polariton) and inhomogeneous wave models are considered. For the latter model, the theory is complex although a line shape expression is derived for the case of high exciton velocity and low oscillator strength. The related problem of determining the conditions under which the strong exciton—photon coupling limit is attained is also discussed. It is in this limit that light attenuation is independent of the oscillator strength. The theory plus new experimental data on the a exciton of naphthalene argue for the inadequacy of the polariton model. On the other hand, reasonable agreement between the data and the spatially inhomogeneous wave theory developed here is obtained. Thus, it is possible to estimate that the exciton—photon coupling contribution to the a-exciton linewidth is 0.26 cm^{-1}. This is the major portion of the 2 K linewidth of 0.3 cm^{-1}.

8968 Rarefied gas dynamics. Potter, J.L. (ed.). New York; American Institute of Aeronautics and Astronautics (1977). 682p. (CONF-760710—P2).

From 10. international symposium on rarefied gas dynamics; Aspen, CO, USA (18 Jul 1976).

Seven items from part 2 of the conference were prepared for the data base. These items are primarily concerned with atom and molecular beams and their interactions. (GHT)

8969 Pulsed NMR studies of matrix isolated HCl and $(HCl)_2$. Kohl, J.E.; Semack, M.G.; White, D. (Department of Chemistry and Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *J. Chem. Phys.;* **69**: No. 12, 5378-5385(15 Dec 1978).

A proton free probe suitable for pulsed NMR studies of matrix isolated molecules has been used to obtain the proton spectrum of HCl in solid ^{40}Ar for HCl mole fraction $0.003 < x < 0.02$. The spectrum consists of a central Lorentzian associated with the HCl monomer superimposed on a well-defined Pake doublet due to the dimer $(HCl)_2$. The Pake doublet is a result of the proton—proton dipolar interactions between the dimer HCl units. A structural parameter of the $(HCl)_2$ ground state configuration is calculated from the doublet splitting. For the linear hydrogen bond the angle between the HCl unit containing the non-hydrogen-bonded proton and the axis containing the H bond is approximately 122°. An upper limit of 150 μsec for the chlorine spin—lattice relaxation time is calculated from the observed broadening of the Pake line shape. The linewidth of the HCl monomer is roughly an order of magnitude larger than that calculated from model systems used to account for the infrared absorption of matrix isolated HCl. It is suggested that this discrepancy is the result of a much more anisotropic matrix environment than previously assumed.

8970 Neutron scattering study of thermally excited density fluctuations in a dense classical fluid. Postol, T.A.; Pelizzari, C.A. (Solid State Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev., A;* **18**: No. 5, 2321-2336(Nov 1978).

Collective density fluctuations in ^{36}Ar gas at 456 atm pressure and 295 K have been studied by thermal-neutron scattering using time-of-flight techniques. Well-defined collective modes are observed for wave-vector transfers $k <$ or $\simeq 0.1$ A^{-1} which become strongly damped at larger k. The data have been compared in detail with predictions of the generalized Enskog equation. Although extrapolation of the predictions to $k = 0$ gives the correct transport coefficients to better than 5% accuracy, the generalized Enskog equation does not properly predict the wave-vector dependence of the scattering law.

BEAMS AND THEIR REACTIONS

REFER ALSO TO CITATION(S) 9152

8971 Angular distribution of ejected particles from ion-bombarded clean and reacted single-crystal surfaces. Winograd, N.; Garrison, B.J.; Harrison, D.E. Jr. (Department of Chemistry, Purdue University, West Lafayette, Indiana 47907). *Phys. Rev. Lett.;* **41**: No. 16, 1120-1123(16 Oct 1978).

The expected angular distributions of ejected particles from ion-bombareded clean and reacted single-crystal surfaces are calculated using classical dynamics to model the momentum dissipation. For oxygen atoms adsorbed on a Cu(100) lattice in A-top and fourfold and twofold bridged geometries, preferred ejection angles are found for the higher-kinetic-energy particles (> 20 eV). Because of scattering mechanisms which cause atoms to move through gaps in the lattice surface, we find that the patterns for different overlayer registries are easily distinguishable.

8972 Structure effects seen in the dissociation of 3.5-MeV beams of CO_2^+ and N_2O^+ in thin foils. Gemmell, D.S.; Kanter, E.P.; Pietsch, W.J. (Argonne National Lab., Ill. (USA)). *Chem. Phys. Lett.;* **55**: No. 2, 331-334(15 Apr 1978).

Examples of energy spectra obtained for ionic fragments that are emitted in the forward direction when 3.5 MeV beams of CO_2^+ and N_2O^+ dissociates in thin (approximately 150 A) carbon foils are shown. The spectra demonstrate in a novel way the structures of the two species of incident molecular ions.

8973 Ion-optical characteristics of an H^- beam from a surface-plasma source. Derevyankin, G.E.; Dudnikov, V.G.; Klenov, V.S. (Institute of Nuclear Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 2, 239-240(Feb 1978).

The performance of a Penning discharge ion source is evaluated. It is found that the H^- beams produced are comparable in intensity to that of proton beams. (AIP)

8974 Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977). 359p. (CONF-760749—). $19.00.

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

There were 12 papers presented, one of which appeared previously in ERA. Separate abstracts were prepared for 11 papers. (JFP)

8975 Neutralization and inelastic energy losses in low-energy ion scattering. Heiland, W. (Bell Labs., Murray Hill, NJ); Taglauer, E. pp 27-46 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

The experimental results related to the inelastic ion-surface interaction is outlined, and the mechanisms involved are discussed. Electronic stopping, electron emission, excitation and neutralization of the projectiles are considered. 51 references. (JFP)

8976 Neutralization behavior in medium energy ion scattering. Buck, T.M. (Bell Lab., Murray Hill, NJ). pp 47-71 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

A review is given of some of the experimental literature on the neutralization of ions having primary energies of 5 to 200 keV, as they are reflected from solid surfaces or pass through thin foils. Most of the data are presented in the form of ion-fractions (Y^+/Y) as functions of energy of the scattered particles. A transition is observed: from the behavior of H and He at 30 to 200 keV in which there is no direct evidence of neutralization inside the solid, either because it does not occur or because equilibration lengths are too short to be resolved, to that found in the 5 to 30 keV range where H, He, Ne, and Ar have all shown evidence of enhanced neutralization of ions which penetrate the surface. Present evidence does not permit a confident choice between the theoretical models for protons above 10 keV which assert that neutralization inside the solid is prevented by electron screening, and another (proposed primarily for protons at higher velocities) which accepts the older concept of alternate electron capture and loss inside. Neutralization and scattering results demonstrate that the sharply peaked ion spectra of low energy ion scattering result from a combination of two factors: large scattering cross sections which cause depletion of the ion beam as it enters and leaves the solid and more efficient neutralization of ions which penetrate beyond the surface.

8977 Nonadiabatic neutralization at surfaces: oscillatory ion scattering intensities. Tully, J.C.; Tolk, N.H. (Bell Labs., Murray Hill, NJ). pp 105-119 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

An experimental and theoretical study of the neutralization mechanisms responsible for producing irregular and oscillatory structure in the energy dependence of ion scattering yields was carried out. Analysis of the angular dependence of oscillatory structure provides evidence that a specific binary ion-atom interaction dominates the process. A theory of ion neutralization at surfaces is presented which incorporates both adiabatic (direct resonance and Auger) and nonadiabatic neutralization mechanisms, and which takes into account the energy, symmetry, localization and lifetime of surface electronic states. The theory reproduces the observed irregular and oscillatory ion intensities and establishes without doubt that this behavior arises from a nonadiabatic near-resonant charge exchange mechanism.

8978 Sputtering processes: collision cascades and spikes. Sigmund, P. (Oersted Inst., Copenhagen). pp 121-152 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

Sputtering of solids by ion bombardment is discussed mainly from a qualitative point of view. The elementary processes are described on the basis of few experimental observations and results of collision theory. Special attention is given to the mechanisms of sputtering from atomic collision cascades and spikes. Simple estimates are given for the sputtering yield, and the relation to some differential quantities is discussed. Comments on the sputtering of clusters and on the significance of crystal lattice structure and target surface on the sputtering process are made.

8979 Optical emission from low-energy ion-surface collisions. White, C.W. (Oak Ridge National Lab., TN); Thomas, E.W.; Van

der Weg, W.F.; Tolk, N.H. pp 201-252 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

Impact of energetic heavy particles on surfaces gives rise to emission of optical radiation from reflected particles, sputtered particles and also from excited states of the solid. The present status of research in this area is reviewed with emphasis on understanding the basic mechanisms which give rise to formation of excited states. The spectral line shape from ejected atoms may be analyzed to provide information on the distribution of speeds and directions of the excited species; the line intensity provides a measure of the probability for creating the state. Formation of excited species is related both to the collision processes within the solid and also to the interaction of the recoiling ejected species with the target surface. Most ejected species are atomic but important examples of ejected molecules are also discussed. Luminescence induced in the solid itself is related to recombination of electron hole pairs and is related significantly to the presence of defects.

8980 Processes of charge exchange into the continuum of ionic projectiles interacting with gases and solids. Meckbach, W.; Baragiola, R.A. (Comision Nacional de Energia Atomica, San Carlos de Bariloche, Argentina). pp 283-308 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

A critical survey is given of research on electron ejection into continuum states of fast ionic projectiles bombarding gaseous and solid targets. Emphasis is laid upon the shape of the energy and angular distributions which is evaluated in terms of the vectorial electron-ion velocity difference, and the yield of the process which is discussed as a function of the velocity of the ion. The results are analyzed in comparison with theories and the discrepancies pointed out. The role of "wake riding" electron states in solids is also discussed.

8981 Optical polarization in high energy ion-surface scattering at grazing incidence. Andra, H.J.; Froehling, R.; Ploehn, H.J. (Freie Univ., Berlin). pp 329-348 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

Large circularly polarized light fractions emitted from surface scattered ions when energetic ion beams are impinging on mechanically polished solid surfaces at grazing incidence are reported. First results on the dependence of the observed circular polarization on the surface quality, on the incident grazing angle, on the incident beam energy and on the incident ions are presented. From the analysis of various multiplets of NeII, ArII, KrII the excitation mechanism is interpreted as an orbital angular momentum effect which is governed by the symmetry of the process. Measurements with 10 different incident ions prove this effect to be a general phenomenon. As an application in atomic physics, a zero-field level-crossing experiment is presented.

8982 Observation of ballistic rotors in liquid ^{4}He. Edwards, D.O.; Ihas, G.G.; Tam, C.P. (Ohio State Univ., Columbus). pp 381-385 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The excitations produced when a pulsed ^{4}He atomic beam strikes the surface of liquid ^{4}He held near T approximately OK have been measured as a function of direction in the liquid and time elapsed since the beam was generated. Comparison of the data with a theory which assumes that a single atom is converted into a single excitation indicates that the observed signals are due to ballistic phonons and rotons, although the experimental velocity and angular distributions of the excitations are displaced from the theoretical ones. The direction of the displacements suggests that multiple ripplon production occurs as an atom approaches the liquid surface, as predicted by Echenique and Pendry.

ATOMIC AND MOLECULAR PROPERTIES

REFER ALSO TO CITATION(S) 9004

8983 Relaxation of neodymium in a weakly ionized expanding plasma. Chen, H.; Bedford, R.; Borzileri, C.; Brunner, W.; Hayes, M. (University of California, Lawrence Livermore Laboratory, P.O. Box 808, Livermore, California 94550). *J. Appl. Phys.;* **49**: No. 12, 6136-6141(Dec 1978).

The laser resonance absorption technique has been used to determine the relaxation rate of electronically excited neodymium vapor during its expansion into vacuum. Significant increases of population into ground and 1128-cm^{-1} levels were found. Analysis shows that interaction between excited metastable atoms and electrons are much more important for relaxation than atom-atom collisions. The final population of neodymium appears to be frozen at a temperature lower than the surface temperature of melt.

8984 Ionization and energy pooling in laser-excited Na vapor. Bearman, G.H.; Leventhal, J.J. (Department of Physics, University of Missouri at St. Louis, St. Louis, Missouri 63121). *Phys. Rev. Lett.;* **41**: No. 18, 1227-1230(30 Oct 1978).

We have observed ion formaion (both Na^+ and Na_2^+) and radiation from high-lying Na states when low-density vapor ($\sim 10^{13}$ cm^{-3}) is irradiated with a cw dye laser tuned to one of the D lines. The Na^+ ions probably results from photodissociation of Na_2^+ formed by Na(3p) -Na(3p) associative ionization, while the high-lying radiating states are formed in energy-pooling reactions.

8985 Absorption spectrum of atomic lithium in high magnetic fields. Lu, K.T.; Tomkins, F.S.; Crosswhite, H.M.; Crosswhite, H. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev. Lett.;* **41**: No. 15, 1034-1036(9 Oct 1978).

Quasi-Landau resonances have been recorded for lithium atoms in magnetic fields of up to 47 kG, with a spacing of only half the cyclotron frequency rather than 3/2 as expected from previous theory. The intensity distribution over satellites in the l-mixing region (including the appearance of parity-forbidden transitions) is discussed in terms of magnetic mixing among nearly degenerate levels. As intensity sum rule is demonstrated.

POSITRONIUM, MUONIUM, AND MUONIC AND MESIC ATOMS AND MOLECULES

REFER ALSO TO CITATION(S) 9107, 9221

8986 New theoretical prediction of the ground-state hyperfine splitting in muonium. Caswell, W.E.; Lepage, G.P. (Department of Physics, Brown University, Providence, Rhode Island 02912). *Phys. Rev. Lett.;* **41**: No. 16, 1092-1094(16 Oct 1978).

We have computed a new contribution to the ground-state hyperfine splitting in muonium: $-2(\alpha/\pi)^2(m/M)[\ln(M/m)]^2$ E/sub F/ = -6.6 kHz. Uncalculated theoretical contributions are expected to be no larger than a few kHz. The new theoretical estimate, ν/sub theor/ = 4 463 297.9(7.0) kHz is in good agreement with experiment: ν/sub exp/ = 4 463 302.35(0.52) kHz. The bulk of the uncertainty in the theory is due to uncertainty in the measured value of μ/sub μ//μp.

COLLISION PHENOMENA

REFER ALSO TO CITATION(S) 9152

8987 (COO—4361-1) Fluorescent scattering by molecules embedded in small particles. Progress report, May 1, 1977—October 31, 1978. Chew, H.; McNulty, P.J. (Clarkson Coll. of Tech., Potsdam, NY (USA). Dept. of Physics). 14 Jul 1978. Contract EE-77-S-02-4361. 13p. Dep. NTIS, PC A02/MF A01.

A model for the fluorescence and Raman scattering by molecules that comprise or are embedded in small particles was developed and numerical calculations performed. The emphasis during this first year of the contract was on writing and testing the computer programs necessary for numerical calculations and on demonstrating the extent of the potential effects that the geometrical and optical properties of the particle would have on the Raman and fluorescent emissions. For the purpose of demonstrating effects emphasis was focused upon the case of isotropically polarizable molecules that fluoresce or Raman scatter through electric dipole transitions. Some preliminary results are described. One result of these investigations that is of particular significance for remote sensing of pollutants is that it would be a serious mistake to use inelastic scattering techniques such as Raman and fluorescent scattering for quantitative assay of specific molecules in aerosols containing particulates without taking into account the size, structure and refractive index of the particles. A list of publications is included.

8988 Doppler-shift analysis of continuum x radiation from quasimolecular systems. Vincent, P.; Davis, C.K.; Greenberg, J.S. (Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06520). *Phys. Rev., A;* **18**: No. 5, 1878-1891(Nov 1978).

We show that an internally consistent determination of both the emitter velocity and directional anisotropy of continuum x radiation from heavy-ion collisions provides an important method with which quasimolecular emissions can be identified and distinguished from various backgroumd sources of continuum x rays.

These features are illustrated with measurements on the Ni + Ni and Ni + Nb collision systems utilizing the observation of the forward-backward Doppler shift of the continuum x rays to determine the emitter velocities as a function of photon energy.

8989 Projectile dependence of single-K multiple-L shell vacancy production in argon: A universal scaling of <l>. Schmiedekamp, C.; Doyle, B.L.; Gray, T.J.; Gardner, R.K.; Jamison, K.A.; Richard, P. (Department of Physics, Kansas State University, Manhattan, Kansas 66502). *Phys. Rev., A;* **18**: No. 5, 1892-1901(Nov 1978).

Argon Kα x-ray satellites produced by ion collisions have been analyzed in high resolution. Ions of H, C, N, O, F, Si, and Cl with energies in the range 1—5 MeV/amu were used to bombard argon contained in a gas cell. This study is the first systematic study of K x-ray satellites from free-atom targets with $Z > 10$. The relative satellite intensities and satellite energies are tabulated and their projectile dependence is qualitatively discussed. The average number of L-shell vacancies formed in single-K-vacancy-producing collisions is determined from a model calculation based on theoretical decay rates. This model includes (i) the variation in fluorescence yield, and (ii) the variation in L-shell rearrangement with the number of L-shell and M-shell electrons. The averages obtained from the model calculation are nearly the same as the $< l >$ values obtained by weighting the x-ray satellites equally. A universal scaling of $< l >$ in Z_1 and projectile velocity is obtained on the basis of an increased binding effect. This is the first successful demonstration of a scaling law for multiple ionization by heavy ions.

8990 Electron-hydrogen scattering by complex-optical-potential methods. Coulter, P.W.; Garrett, W.R. (Department of Physics and Astronomy, The University of Alabama, University, Alabama 35486). *Phys. Rev., A;* **18**: No. 5, 1902-1907(Nov 1978).

Multichannel electron scattering by atomic hydrogen is studied by using a complex optical potential. Real and virtual excitation and ionization of the target system as well as electron-exchange effects are included in the calculation. A free-particle Green's function is used as an approximation for the propagator in intermediate states. The contributions of the excited and ionized states to the nonlocal optical potential are examined separately. Ionization and excitation cross sections are calculated exactly without further approximation for electron energies greater than 1 Ry. The calculations are in good agreement with recent experimental measurements of differential cross sections.

8991 Electron-impact ionization of C^{3+} and N^{4+}. Crandall, D.H.; Phaneuf, R.A.; Taylor, P.O. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Phys. Rev., A;* **18**: No. 5, 1911-1924(Nov 1978).

Measured cross sections for electron-impact ionization of C^{3+} and N^{4+} are reported for collision energies between threshold and 500 eV. The measurements were performed with crossed electron and ion beams. The peak cross sections obtained are 2.3×10^{-18} cm^2 near 200 eV for C^{3+} and 1.5×10^{-18} cm^2 near 400 eV for N^{4+} with good-confidence absolute uncertainties of +- 11% and +- 15%, respectively. Comparisons of present data with the available theoretical estimates range from good agreement to discrepancies of a factor of two. At the highest energies of the present measurements, near 500 eV, the cross sections have not yet begun to decrease as predicted by all the available theories. It is postulated that inner-shell-electron excitation followed by autoionization is contributing to the measured ionization cross sections at these energies. Ionization-rate coefficients are derived from the data and compared with those measured in plasmas. The agreement in ionization rates is satisfactory in the C^{3+} case, but discrepancies of nearly a factor of two exist for the N^{4+} case.

8992 Electron capture from atomic hydrogen into excited n, l levels of projectiles with $Z_1 >$ or $= 1$. Golden, J.E.; McGuire, J.H.; Omidvar, K. (Department of Physics, Kansas State University, Manhattan, Kansas 66506). *Phys. Rev., A;* **18**: No. 5, 2373-2376(Nov 1978).

Calculations are presented of cross sections for electron capture from atomic hydrogen to n, l excited states of p^+, α^{++}, and Be^{+4} at velocities of about 100 keV/amu using both the Brinkman-Kramers (BK) and Jackson-Schiff (JS) approximations, and to excited states of O^{+8} in the BK approximation. Capture occurs into levels with increasing n and l as the projectile charge Z_1 is increased. While the BK and JS ratios σ/sub n/l/Σ/sub n/,l σ/sub n/l are quite similar for p + H, these two approximations give rather different distributions in n and l for Be^{+4} where transfer to excited levels dominates.

8993 Change of intensity of spectral lines of multiply charged ions as a result of charge exchange with atomic hydrogen. Abramov, V.A.; Baryshnikov, F.F.; Lisitsa, V.S. *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 464-467(5 May 1978).

A general formula is obtained for the distribution W/sub l/ of the charge-exchange cross sections with respect to the orbital angular momentum. The results of the calculations are used to analyze an experiment on the injection of a beam in the ORMAK installation. The theory developed explains the main qualitative regularities of the line intensities of the impurity ion O^{+7} and provides an estimate of the ratio of the concentrations of the O^{+8} and O^{+7} ions.

8994 Rate and activation energy of the Br + Br_2 atom-exchange reaction. Thompson, D.L. (Los Alamos Scientific Lab., N.Mex. (USA)). *Chem. Phys. Lett.;* **55**: No. 3, 424-427(1 May 1978).

The Br + Br_2 atom-exchange reaction has been studied using quasiclassical trajectories and a semi-empirical potential-energy surface with shallow, long-range wells. The computed reaction rate coefficient is in good agreement with experiment. The computed reaction activation energy is < approximately 1 kcal/mole.

8995 Anisotropic potentials and the damping of rainbow and diffraction oscillations in differential cross sections. Pack, R.T. (Los Alamos Scientific Lab., N.Mex. (USA)). *Chem. Phys. Lett.;* **55**: No. 2, 197-201(15 Apr 1978).

Total differential cross sections are calculated using the IOSA and a new anisotropic 12-6 potential. Rainbows are damped solely by the well depth anisotropy; diffraction oscillations are damped by the well position anisotropy. This separation should aid in the empirical determination of anisotropic potentials.

8996 Angular distribution of fast electrons scattered inelastically in copper. Grachev, B.D.; Kozlovskii, S.S.; Korobochko, Y.S.; Mineev, V.I.; Petrochenko, A.F. (M. I. Kalinin Leningrad Polytechnical Institute). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 110-111(Mar 1978).

Measurements are presented to demonstrate that the angular distribution of inelastically scattered electrons from copper films is the same as those scattered elastically at an angle above the electron-electron peak.(AIP)

8997 Polarization of spectral lines excited in collisions of alkaline earth ions with atoms. Volovich, P.N.; Ovchinnikov, V.L. (Uzhgorod State University). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 2, 173-175(Feb 1978).

The experimental apparatus, which includes a three-channel system for detecting polarized radiation, is described. The detection system counts photoelectrons. The system uses a rotating polarization analyzer, modulation of the ion beam and a reversible count of the photomultiplier pulses. The polarization of the resonant lines of alkaline earth ions and atoms is studied in collisions of Ca^+, Sr^+, and Ba^+ ions with inert gas atoms. The degree of polarization oscillates as a function of the energy, changing sign. These oscillations are not correlated with the structure of the excitation functions. In certain cases these oscillations are regular.

8998 Oscillatory scaattered ion yields in low energy ion-surface scattering. Rusch, T.W.; Erickson, R.L. (3M Co., St. Paul). pp 73-104 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

Recent observations of structure in the energy dependence of scattered ion yields indicate that electronic interactions during the scattering process behave very much like ion-atom collisions. Oscillatory structure observed for the specific cases of He^+ scattering from Ga, Ge, As, In, Sn, Sb, Tl, Pb, and Bi is attributed to quasiresonant charge exchange between the vacant He^+ 1s state and the outer d states of these atoms. This structure is observed to be sensitive to the chemical environment of the target atom. In addition, Fourier analysis of the oscillatory structure suggests that more than one charge transfer mechanism may be present.

8999 Secondary ion production due to ion-surface bombardment. Wittmaack, K. (Gesellschaft fuer Strahlen- und Umweltforschung mbH, Neuherberg, Ger.). pp 153-199 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

Secondary ion production due to ion-surface bombardment is reviewed. Special emphasis is given to a discussion of experimental data which can be used to check the validity of certain emission models. For clean metals bombarded with rare gas ions in the keV energy range the dominant processes leading to the emission of positive ions are autoionization and (for light elements) kinetic ionization, the latter phenomenon involving 1s cr 2p hole production. Analysis of secondary electron spectra indicates a high probability for interaction between Auger electrons and sputtered particles. Accordingly ionization due to Auger electron impact is likely to be important in some cases. Secondary ion emission in the presence of electropositive and/or electronegative elements is discussed in some detail. The enhancement in the positive ion yield due to the presence of oxygen supports the bond breaking model. Differ-

ent from photoemission studies the experimental results cannot be explained on the basis of band structure considerations. The yield of negative metal ions is found to be strongly related to the electron affinity. The yield of clusters, both homonuclear and heteronuclear, exhibits a strong dependence upon the bond strength. Bombardment induced changes in surface structure and stoichiometry are shown to be of pronounced importance. The role of recoil implantation in producing saturation with oxygen is emphasized. The possibility of achieving substrate-independent secondary ion emission pattern from oxygen saturated surfaces is pointed out. Finally it is demonstrated that the current state of the theories of secondary ion emission is unsatisfactory.

ATOMIC AND MOLECULAR THEORY

REFER ALSO TO CITATION(S) 8995

9000 (RLO—1388-371) **Nuclear and atomic probes of the neutral weak currents.** Adelberger, E.G. (Washington Univ., Seattle (USA). Dept. of Physics). 1977. Contract EY-76-C-06-1388. 15p. (CONF-770975—3). Dep. NTIS, PC A02/MF A01.

From International symposium on nuclear physics at cyclotron energies; Calcutta, India (14 Sep 1977).

Experiments which detect parity violation in atomic and nuclear states can provide information on the space-time and isospin structure of the neutral weak current. Recent experimental results from the University of Washington involving atomic and nuclear systems are discussed. 24 references.

9001 **Nuclear corrections to molecular properties. VI. Vibrational transition moments in asymmetric-top molecules.** Krohn, B.J.; Kern, C.W. (Los Alamos Scientific Laboratory, Theoretical Division, Los Alamos, New Mexico 87545). *J. Chem. Phys.;* **69**: No. 12, 5310-5313(15 Dec 1978).

A general expansion is derived for the transition moment between two nondegenerate vibrational states of a polyatomic molecule. This analysis is combined with ab initio surfaces for the potential energy and the dipole moment of water vapor to predict integrated band absorption intensities. Calculations are compared with experiment for several transitions which originate in the zero-point vibrational state.

9002 **Quantum electrodynamics of source field detection and quantum beats.** Khoo, I.C.; Eberly, J.H. (Ames Laboratory, Energy Research and Development Administration, Iowa State University, Ames, Iowa 50011). *Phys. Rev., A;* **18**: No. 5, 2184-2191(Nov 1978).

The quantum electrodynamics of two atoms in free space, separated by many wavelengths and interacting with one another via the coupling of their dipole moments to the electromagnetic field, is studied using the Heisenberg-operator approach. The problem is formulated in such a way that one of the atoms, which has two levels, plays the role of a detector; the other atom, whose levels are arbitrary but do not involve cascadelike transitions, plays the role of the source. Several aspects of the interaction are considered, including: a review of photodetection theory, the theory of an alternative detection method that uses an excited-state detector, and a study of quantum beats. These dynamical studies of emission and detection provide new insights into the observation of quantum beats in the transition rate of a detector. We show that ground-state beats are not observed by a detector atom making an upward transition, but that ground-state beats are, in principle, observable if the detector atom makes a downward transition.

9003 **Molecular-photoelectron angular distributions as a probe of dynamic symmetry breaking.** Dill, D.; Wallace, S.; Siegel, J.; Dehmer, J.L. (Department of Chemistry, Boston University, Boston, Massachusetts 02215). *Phys. Rev. Lett.;* **41**: No. 18, 1230-1233(30 Oct 1978).

Molecular-photoelectron angular distributions are shown to depend qualitatively on symmetry-breaking hole localization during inner-shell photoionization. This is illustrated by comparing localized and delocalized calculations of the asymmetry parameter β (ϵ) for K-shell photoionzation of N_2 in the vicinity of the f-type shape resonance at approximately 10 eV above threshold. Comparison with the isoelectronic CO shows that the K-shell β (ϵ) for N_2, in the localized treatment, resembles that for the K shell of oxygen rather than carbon in CO.

9004 **Low energy de-excitation and neutralization processes near surfaces.** Hagstrum, H.D. (Bell Labs., Murray Hill, NJ). pp 1-25 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

The electronic transitions near solid surfaces that deexcite and neutralize atomic particles carrying potential energy, such as Auger neutralization and the two-stage process of resonance neutralization followed by Auger de-excitation, are discussed. Experimental evidence for atomic energy level variation near surfaces is reviewed and the critical distance separating regions outside the surface where different processes occur is defined. Further evidence for the general validity of the theoretical picture is that provided in the investigation of the processes occurring for the metastably excited He^+ (2s) ion.

FLUID PHYSICS

REFER ALSO TO CITATION(S) 8753

GENERAL FLUID DYNAMICS

9005 (ANL—78-80) **Numerical methods for a porous medium equation.** Rose, M.E. (Argonne National Lab., IL (USA)). Aug 1978. Contract W-31-109-ENG-38. 59p. Dep. NTIS, PC A04/MF A01.

The degenerate parabolic equation par. delta u/par. delta t = div (u/sup nu/grad u), nu $>$ 0 was used to model the flow of gas through a porous medium. Error estimates for continuous and discrete-time finite-element procedures to approximate the solution of this equation are proved, and a new regularity result is described.

9006 **Solitary structures in nonlinear fields.** Krumhansl, J.A. (Cornell Univ., Ithaca, NY). pp 51-64 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

An overview of recent work in nonlinear fields is presented, with intent to provide a pedagogical introduction to the recent literature. The ideas reach into many branches of physics, chemistry, and continuum mechanics. The significant feature of strong nonlinearity is that spatially extended waves interact and organize into well-characterized, localized objects. The result is that objects like domain walls, dislocations, and such may be found. These structures rely on the nonlinearity inherent in the problem to such an extent that they can not be generated by a perturbation theory starting with a plane-wave basis. Most important, they have static and dynamic stability in a wide number of cases, and play a significant role in both the statistical and quantum mechanical descriptions of many physical systems.

SUPERFLUIDITY

REFER ALSO TO CITATION(S) 8684

9007 **Nonvortical phase slippage and oscillations of the vector l in He^3-A.** Volovik, G.E. (L. D. Landau Institute of Theoretical Physics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 11, 573-576(5 Jun 1978).

It is shown that the difference of the chemical potentials in He^3-A can be maintained by oscillations of the vector l in the absence of vortical motion. The force of friction between the normal and superfluid components turns out to be proportional to (v/sup s/—v/sup n/)^3.

9008 **Three-dimensional solitons in He II.** Iordanskii, S.V.; Smirnov, A.V. (L. D. Landau Institute of Theoretical Physics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 535-538(20 May 1978).

It is shown that three-dimensional stationary wave packets: solitons: can propagate in He II in the case of positive dispersion. A numerical solution of the equation that describes these packets is obtained, and the corresponding branch of the excitation spectrum is calculated. The question of excitation of a soliton by an electromagnetic wave is considered.

9009 **Quantum fluids and solids.** Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977). 481p. (CONF-770122—). $47.50.

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Information on the physics of superfluids and quantum solids is covered in the proceedings. Areas covered include: neutron scattering, ion motion and zero sound in liquid ^{3}He; unusual quantum systems like spin-aligned hydrogen, ^{6}He, superfluid solids, and liquid crystals; solid helium; quantum fluids and solids at low dimensionality; and properties of ^{3}He-^{4}He mixtures. (GHT)

9010 **Surface singularities and superflow in ^{3}He—A.** Mermin, N.D. (Cornell Univ., Ithaca, NY). pp 3-22 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Except in a toroidal container, the order parameter in ^{3}He-A must have singularities at the surface. Examples of such singularities are given, and a relation between the surface topology and the kinds of singularities is derived. Quantization of circulation along surface contours is discussed, and examples of the decay of superflow through the motion of surface singularities are given.

9011 Textures of ^{3}He—A in a sphere: topological theory of boundary. Anderson, P.W.; Palmer, R.G. (Princeton Univ., NJ). pp 23-32 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

General methods for topological classification of surface defects allowed or implied by given boundary conditions are suggested and it is shown how these surface defects are related to bulk defects or textures. These ideas are then applied to the classification of boundary defects of ^{3}He-A in a sphere, and by matching these to bulk singularities or textures, all solutions the "^{3}He-A in a sphere" problem are found.

9012 Static and dynamic textures in superfluid ^{3}He—A. Buchholtz, L.J.; Fetter, A.L. (Stanford Univ., CA). pp 33-43 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Static textures in confined superfluid ^{3}He-A near T/sub c/ are studied with the Ginzburg-Landau free energy. Plane boundaries induce a uniform texture that becomes deformed at a critical perpendicular magnetic field; above that value, the mean superfluid density measured in torsional oscillations decreases monotonically. Cylindrical boundaries induce a flared texture, with a circulating current; this configuration deforms continuously with increasing axial magnetic field up to a critical value, when a discrete transition takes place to a planar texture with neither current nor angular momentum. Leggett's dynamical equations are generalized to incorporate static inhomogeneous textures, which then represent the zero-order solutions in the presence of a weak r-f field. The first-order response characterizes the various textures, which may permit an unambiguous experimental identification.

9013 Stability of planar textures n superfluid ^{3}He—A. Kumar, P. (Univ. of Southern California, Los Angeles). pp 45-49 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Planar structures in ^{3}He-A are studied by relaxing assumed constraints. The pure d (vector) texture is detailed.

9014 Solitons and related phenomena in superfluid ^{3}He. Maki, K. (Univ. of Southern California, Los Angeles). pp 65-84 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Solitons (or planar textures) in superfluid ^{3}He are reviewed. In the A phase, solitons are classified into d-soliton, l-soliton and composite soliton. In an open system the last one is the only stable soliton. Creation of d-soliton by magnetic means, and magnetic resonances associated with a variety of solitons are described.

9015 Experimental orbital dynamics in superfluid ^{3}He. Wheatley, J.C. (Univ. of California, San Diego, La Jolla). pp 85-96 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The principles and methods of producing dynamic orbital response in ^{3}He-A are discussed. Experiments and their interpretation are also presented for sudden magnetic field rotations and persistent orbital motions.

9016 Orbital hydrostatics and hydrodynamics of ^{3}He—A. Ho, T.L. (Cornell Univ., Ithaca, NY). pp 97-104 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The conditions for hydrostatic equilibrium in ^{3}He-A and the equations that describe the non-linear orbital hydrodynamics are given.

9017 General equilibrium condition and hydrodynamics of superfluid ^{3}He—A. Hu, C.R. (Texas A and M Univ., College Station). pp 105-109 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The derivation of the general set of hydrodynamic equations of ^{3}He-A is presented without detailed argument. These equations incorporate the nonlinear effects due to an inhomogeneous equilibrium texture and a steady-state flow, and generalize the hydrodynamics of Graham (and Liu) which is limited to a uniform texture with no steady-state flow. (GHT)

9018 Magnetic susceptibility of superfluid ^{3}He. Serene, J.W. (State Univ. of New York, Stony Brook); Rainer, D. pp 111-116 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The results of a strong-coupling calculation of the magnetic susceptibility of superfluid helium 3, including all corrections through first order in T/sub c//T/sub F/. In particular, the implications of the strong-coupling theory for the possibility of extracting $\Delta(T)$ and F_2/sup a/ from the measured susceptibility are discussed. (GHT)

9019 Amplitude dependent effects in the measurement of the ^{3}He— A-phase superfluid density tensor. Main, P.C. (Manchester Univ., Eng.); Band, W.T.; Hook, J.R.; Hall, H.E.; Sandiford, D.J. pp 117-125 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

An oscillating annular channel containing superfluid ^{3}He-A has been used to measure average values of the superfluid density for different amplitudes of oscillation. The results have the same form as the prediction of theory, and are in agreement with a ratio of two for the perpendicular and parallel components of the superfluid density tensor near T/sub c/. A value of rho/sub s perpendicular/ = 1.1 rho (1-T/T/sub c/) is obtained at 29.7 bar.

9020 Some new NMR effects in superfluid ^{3}He—A. Giannetta, R.W.; Gould, C.M.; Smith, E.N.; Lee, D.M. (Cornell Univ., Ithaca, NY). pp 133-147 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Longitudinal and transverse satellite lines have been observed by CW techniques in superfluid ^{3}He-A under a variety of experimental conditions. A new metastable mode has been observed in superfluid ^{3}He-A using pulsed NMR techniques. The frequency shift of this mode is related to the frequency shift of the transverse satellite line.

9021 Pulsed NMR frequency shift in superfluid ^{3}He—B. Gould, C.M. (Cornell Univ., Ithaca, NY). pp 149-152 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

A significant discrepancy exists between theory and measurements of the magnetization precession frequency following large angle tipping pulses in superfluid ^{3}He-B. Here it is shown that the resolution of this discrepancy lies in a more complete treatment of the equations of spin dynamics.

9022 NMR in flowing superfluid ^{3}He in confined geometries. Flint, E.B.; Adams, E.D.; Mueller, R.M. (Univ. of Florida, Gainesville). pp 153-159 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The transverse NMR of superfluid ^{3}He A and B has been studied as a function of flow velocity in two different channel geometries. In the A phase, for the parallel plate geometry, a fraction or all of the signal was found to shift to lower frequencies with flow. In addition, the NMR signal of the flowing liquid developed a time dependent structure under certain conditions. The signal of the static liquid confined between parallel plates was found to split for a field angle of 45° relative to the plates and for temperatures near the A-B transition. None of the above effects was observed in the B phase.

9023 Some unusual characteristics of ^{3}He—B. Osheroff, D.D. (Bell Labs., Murray Hill, NJ). pp 161-170 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Three unusual characteristics of ^{3}He-B which have been observed in continuous wave nuclear magnetic resonance studies over the past three years are analyzed. They include evidence for the existence of textural singularities in ^{3}He-B, unusual spin wave related behavior of B phase samples in highly homogeneous magnetic fields, and power dependent distortions of the B phase absorption lineshape.

9024 Extraordinary magnetism on surface layers of ^{3}He. Ahonen, A.I.; Kokko, J.; Lounasmaa, O.V.; Paalanen, M.A.; Richardson, R.C.; Schoepe, W.; Takano, Y. (Helsinki Univ. of Tech.). pp 171-177 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The nuclear magnetic susceptibility of ^{3}He, confined within the open space around 9 nm carbon particles at liquid pressures, grows very large at low temperatures. Below 2 mK the inverse susceptibility is proportional to T—Δ; Δ has the value 0.75 mK at 6 bar and 0.85 mK at 28 bar pressure of the liquid.

9025 Thermal time constant between powdered CMN and superfluid ^{3}He. Chainer, T.; Kojima, H. (Rutgers—The State Univ., New Brunswick, NJ). pp 179-182 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

A simple RPA model employing the Landau quasi-particle-quasihole interaction is used to describe the density and spin-density excitations observed in recent neutron scattering measurements on normal liquid ^{3}He. The model provides a good description of the excitations observed at T = 0.015°K and suggests that the scattering intensity may be significantly temperature dependent.

9026 Calculation of surface energies in A and B phases of ^{3}He. Cross, M.C. (Bell Labs., Murray Hill, NJ). pp 183-194 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The surface energies of superfluid helium 3 at interfaces between helium 3 A and helium 3 B, between liquid and solid, and between liquid and vapor are important in phase nucleation, phase stability in small geometries, equilibrium textures and dynamical boundary conditions. Emphasis is placed here on surface energies relevant to phase nucleation, particularly the problem of nucleating the B phase on cooling. (GHT)

9027 Excitations in normal liquid ^{3}He. Glyde, H.R. (Univ. of Ottawa); Khanna, F.C. pp 207-222 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

A simple RPA model employing the Landau quasi-particle-quasihole interaction is used to describe the density and spin-density excitations observed in recent neutron scattering measurements on normal liquid ^{3}He. The model provides a good description of the excitations observed at T = 0.015°K and suggests that the scattering intensity may be significantly temperature dependent.

9028 Motion of ions in normal and superfluid ^{3}He. Kurkijarvi, J. (Univ. of Helsinki); Fetter, A.L. pp 233-243 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The drag force on an ion in lower temperature ^{3}He in the normal state and in the superfluid state is discussed, and numerical results are given for the nonlinear high velocity regime of the mobility in the superfluid B phase in the elastic scattering approximation.

9029 Mobility of negative ions in superfluid ^{3}He. Ahonen, A.I.; Kokko, J.; Lounasmaa, O.V.; Paalanen, M.A.; Richardson, R.C.; Schoepe, W.; Takano, Y. (Helsinki Univ. of Tech.). pp 245-252 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The mobility of negative ions is shown to increase rapidly below T/sub c/ in both superfluid ^{3}He phases. The ratio μ/μ/sub N/ of superfluid to normal mobility is larger in the B phase than in the A phase. A critical velocity consistent in magnitude with the Landau limit for pair breaking has also been observed. In the normal fluid we find a temperature independent mobility between 40 mK and T/sub c/ for all pressures between 0 and 28 bar. The increase of μ/sub N/ with increasing pressure is in agreement with the bubble model for the negative ion.

9030 Motion and mobility of ions in superfluid ^{3}He. Soda, T. (Tokyo Univ. of Education). pp 253-257 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The mobility of ions in superfluid ^{3}He-B and -A is calculated near the transition temperature and at absolute zero, taking into account the ionic recoil and using the low temperature approximation for the Van Hove scattering function of an ion.

9031 Possible "new" quantum systems: a review. Nosanow, L.H. (National Science Foundation, Washington, DC). pp 279-291 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The current status of the theory of the possible "new" quantum systems, helium-six and spin-aligned hydrogen, is given. Results of ground-state calculations are combined with finite temperature experimental data to give an over-all view of quantum systems which obey both Bose-Einstein and Fermi-Dirac statistics. An essential feature of this work is the use of the quantum theorem of corresponding states, which allows one to treat the quantum parameter eta = dirac constant^2/m epsilon sigma^2 as a "Conceptual" thermodynamic variable. In this context, the liquid-to-crystal and liquid-to-gas transitions are discussed for quantum systems and shown to be affected profoundly by the statistics. Further, the construction of the phase diagram for ^{6}He and ^{6}He-^{4}He mixtures is reviewed and the possibility of detecting superfluid ^{6}He is discussed. Finally, the predicted properties of spin-aligned hydrogen are reviewed and a brief discussion of the experimental problem of preparing it is given.

9032 Predicted stability conditions for gaseous spin-aligned hydrogen. Stwalley, W.C. (Univ. of Iowa, Iowa City). pp 293-298 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Spin aligned hydrogen is an extremely interesting form of hydrogen where all electronic spin projections (M/sub s/) are parallel so that chemical recombination to H_2 cannot occur. Here only the lowest energy (M/sub s/ = - ½) form is considered. Because it is the most quantal atomic system possible, spin-aligned hydrogen is predicted to remain a gas to absolute zero (for pressures less than the solidification pressure of approx. 50 atm.). It should show the extreme quantum behavior of a nearly ideal Bose gas, including Bose-Einstein condensation and superfluidity. Arguments are briefly reviewed and updated concerning the stability of spin aligned hydrogen (GHT)

9033 Survey of the central issues concerning superfluid solids. Saslow, W.M. (Texas A and M Univ., College Station). pp 299-305 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

A survey is presented on the subject of superfluidity in solids. The meaning of superfluidity in solids is given and a method for calculating the superfluid fraction is given. 16 refs. (GHT)

9034 Number fluctuations in a macroscopic subvolume of quantum fluids: a possible experiment. Bernat, T.P. (Louisiana State Univ., Baton Rouge). pp 307-313 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The particle number fluctuations in a macroscopic subvolume of a quantum Bose fluid are considered, and the effects of the existence of a Bose-Einstein condensate on the magnitude of number fluctuations is discussed. The feasibility of measuring such particle number fluctuations is analyzed and the possibility is offered that such measurements could provide information on the existence of a Bose-Einstein condensate in liquid ^{4}He as well as the recently discussed "exotic" quantum fluid, polarized atomic hydrogen.

9035 Critical dynamics in ^{3}He—^{4}He mixtures. Siggia, E.D. (Univ. of Pennsylvania, Philadelphia). pp 349-350 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

A phenomenological model for the critical dynamics of He^3—He^4 mixtures is studied in the tricritical region and along the lambda line for T > T/sub lambda/. Calculations are done to first order in epsilon = 4-d since our predictions begin to deviate from mean field theory below four dimensions. At the tricritical point, the mass diffusion constant, D, varies with the inverse correlation length as k/sup x/ where x = epsilon/3 + theta(epsilon^2) in disagreement with previous mode coupling theories. The crossover scaling functions from the tricritical to critical regions are calculated for all the singular transport and kinetic coefficients in our model. A suitably defined effective exponent is found to vary non-monotonically in the crossover regime. Although our results are consistent with present experiments, at the tricritical point our model suffers from ambiguities similar to those discussed by Halperin, Hohenberg and Ma for their model C.

9036 Optical experiments in ^{3}He—^{4}He mixtures near the tricritical point. Leiderer, P. (Technische Univ., Munich). pp 351-360 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Phonon-^{3}He quasiparticle scattering times in dilute mixtures of ^{3}He in liquid ^{4}He have been determined using the fast-heat-pulse technique. These scattering times were found to be in reasonably good numerical agreement with those theoretically calculated for Rayleigh-like scattering by Baym and Ebner. The scattering is shown to exhibit a strong pressure dependence.

9037 Transport properties in liquid ^{3}He—^{4}He mixtures near the tricritical point. Meyer, H.; Roe, D.; Ruppeiner, G. (Duke Univ., Durham, NC). pp 361-368 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Results are presented from acoustic attenuation measurements in helium 3—helium 4 mixtures carried out in the range between 1 and 45 MHz. An account is given of an analysis of transient effects occurring during sound velocity measurements, and which lead to some conclusions on the thermal diffusivity ratio K/sub T/. (GHT)

9038 Phonon-quasiparticle scattering in dilute ^{3}He/^{4}He mixtures. Kummer, R.B.; Narayanamurti, V.; Dynes, R.C. (Bell Labs., Murray Hill, NJ). pp 369-373 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Phonon-^{3}He quasiparticle scattering times in dilute mixtures of ^{3}He in liquid ^{4}He have been determined using the fast-heat-pulse technique. These scattering times were found to be in reasonably good numerical agreement with those theoretically calculated for Rayleigh-like scattering by Baym and Ebner. The scattering is shown to exhibit a strong pressure dependence.

9039 Effective interaction between ^{3}He quasi-particles on the surface of liquid ^{4}He. Edwards, D.O.; Feder, J.D.; Nayak, V.S. (Ohio State Univ., Columbus). pp 375-380 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Measurements of surface tension and of the velocity of surface sound have shown that less than a monolayer of ^{3}He adsorbed on the surface of superfluid ^{4}He behaves like a two-dimensional gas of ^{3}He "quasiparticles" with an effective mass M about 1.3 times the real mass m_3. The interaction potential between the surface quasiparticles has been found to be quite weak. When interpreted in terms of an "effective interaction" V/sup s/(q), the analog of the BBP^2 interaction V(q) between ^{3}He dissolved in bulk ^{4}He, the data give: V/sup s/(q = 0) = +(0.5 +- 2.0) x 10^{-31} erg cm^2. The sign and magnitude of V/sup s/(q) are important because they determine whether the adsorbed ^{3}He will become a two-dimensional BCS superfluid at a sufficiently low temperature. Some naive theoretical arguments are presented to augment information about V/sup s/(q) and the possibility of superfluidity.

9040 Second sound attenuation in rotating ^{4}He. Zinov'eva, K.N. (Inst. for Physical Problems, Moscow); Tsakadze, S.Y. pp 387-394 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Experiments on second sound in ^{4}He in an axial mode resonator at T = 1.53°K were performed in the presence of steady supracritical heat flow (approximately 10^{-3} w/cm^2). It is shown that there is an additional attenuation of second sound on bended vortex lines. After rotation is stopped this attenuation grows because of random distribution of vortices in heat flow.

9041 Phase separation in rotating ^{3}He—^{4}He solutions. Glaberson, W.I.; Ostermeier, R.M. (Rutgers—The State Univ., New Brunswick, NJ). pp 395-404 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Experiments were carried out on the effect of ion interaction with vortices through hydrodynamic potential which is essentially the hydrodynamic kinetic energy deficit in the system associated with the presence of the ion in the vicinity of the vortex line. At the higher temperatures (approx. 1.6°K), thermal activation out of the vortex well gives rise to an apparent cross-section much smaller than predicted. At lower temperatures, below approximately 1.4°K, the cross section is also much smaller than predicted for reasons which are explained. (GHT)

9042 Results from a gauge theory of superfluidity in ^{4}He. Chela Flores, J. (Centro de Fisica, I.V.I.C., Caracas). pp 405-409 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The previous gauge theory of superfluidity of ^{4}He is completed and used to evaluate the liquid structure factor for small values of the momentum transfer.

9043 Free surface of rotating ^{4}He thick films. Marston, P.L.; Fairbank, W.M. (Stanford Univ., CA). pp 411-420 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Surface profiles of He II with an initial thickness of 6-50 μm were measured for a rotating and stationary cylindrical container. Equilibrium profiles are consistent with (v/sub s theta/) = v/sub n theta/) = omega r, v/sub nr/ > 0 and (v/sub sr/) < 0. Metastable depressions created after sudden spin-up appear to be a superfluid vortex with a circulation of several hundred h/m.

9044 Decay of persistent currents in unsaturated superfluid ^{4}He films. Telschow, K.K.; Ekholm, D.T.; Hallock, R.B. (Univ. of Massachusetts, Amherst). pp 421-425 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Persistent currents of unsaturated ^{4}He films are observed to decay at a rate which depends strongly on film thickness. Preliminary results on the temperature dependence of the decay rate are reported. Possible models which might explain the observed features of the decays are discussed.

9045 Elementary excitations in very thin superfluid ^{4}He films. Rutledge, J.E.; McMillan, W.L.; Mochel, J.M. (Univ. of Illinois, Urbana). pp 427-439 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

High precison measurements of third sound velocity in ^{4}He films between 0.1 K and 1.5 K for superfluid surface densities between 0.16 atomic layers and 5.25 atomic layers. By reformulating Landau's quantum hydrodynamics using only the area density it has been possible to use these measurements to describe an elementary excitation spectrum and to add a surface roton branch. (GHT)

9046 Recent advances in dilution refrigeration. de Waele, A.Th.A.M.; Reekers, A.B.; Gijsman, H.M. (Eindhoven Univ. of Tech., Netherlands). pp 451-463 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Recent efforts to reach lower temperatures are described. In 1976 the successful operation was reported of two ^{3}He-circulating refrigerators maintaining temperatures below 4 mK continuously. In the machines the ^{3}He flowing into the (final) mixing chamber was precooled in two different ways. In the first method, used by Frossati and Thoulouze, continuous heat exchangers, with a large surface area and a free passage for the liquid, were employed. The lowest reported temperature is about 3.5 mK continuously. This method is discussed only briefly. In the second method, the refrigerator is equipped with more than one mixing chamber. The ^{3}He flowing into the final mixing chamber is precooled by the other mixing chambers. This method will be discussed in more detail.

9047 Tricritical points and light scattering in ^{3}He—^{4}He mixtures. Stephen, M.J. (Rutgers—The State Univ., New Brunswick, NJ). pp 501-508 of Theory of light scattering in condensed matter. Bendow, B.; Birman, J.L.; Agranovich, V.M. (eds.). New York; Plenum Press (1976).

From Soviet-American symposium on theory of light scattering in solids; Moscow, USSR (26 May 1975).

The critical behavior of the thermodynamic quantities near tricritical points is determined in three dimensions. It is shown that the mean field theory is modified by logarithmic corrections, and these logarithmic corrections are determined for the free energy coefficient, coexistence line, order parameter, surface tension, and coherence length. Recent light scattering data near the tricritical point in He^3—He^4 mixtures is discussed. 1 figure.

9048 Critical scattering of light by a two-component fluid. Ferrell, R.A. (Univ. of Maryland, College Park). pp 509-516 of Theory of light scattering in condensed matter. Bendow, B.; Birman, J.L.; Agranovich, V.M. (eds.). New York; Plenum Press (1976).

From Soviet-American symposium on theory of light scattering in solids; Moscow, USSR (26 May 1975).

A phenomenological approach to the problem of predicting the critical correlation function of a binary liquid is discussed. The main physical ideas are emphasized, especially the analogy with relativistic field theory. The principal mathematical tool is Cauchy's theorem and analytic continuation of the correlation function into the complex momentum plane. In this way the correlation function can be expressed by a dispersion relation involving a positive definite spectral function. The practical advantages of the method for fitting data are illustrated. 7 figures.

HIGH ENERGY PHYSICS

9049 Particles and fields-1977. Schreiner, P.A.; Thomas, G.H.; Wicklund, A.B. (eds.). New York; American Institute of Physics (1978). 509p. (CONF-771089—).

From Particles and fields meeting; Argonne, IL, USA (6 Oct 1977).

The conference contained 30 papers, six of which appeared previously in ERA. Separate abstracts were prepared for 24 papers. (JFP)

PARTICLE INTERACTIONS AND PROPERTIES - EXPERIMENTAL

ELECTROMAGNETIC INTERACTIONS

REFER ALSO TO CITATION(S) 8839

9050 Inclusive γ and π^0 production in e^+e^- annihilation. Scharre, D.L.; Fong, A.; Pun, T.P.; Barbaro-Galtieri, A.; Dorfan, J.M.; Ely, R.; Feldman, G.J.; Feller, J.M.; Gobbi, B.; Hanson, G.; Jaros, J.A.; Kwan, B.P.; Lecomte, P.; Litke, A.M.; Lueke, D.; Madaras, R.J.; Martin, J.F.; Miller, D.H.; Parker, S.I.; Perl, M.L.; Peruzzi, I.; Piccolo, M.; Rapidis, P.A.; Ronan, M.T.; Ross, R.R.; Trippe, T.G.; Vuillemin, V.; Yount, D.E. (Stanford Linear Accelerator Center and Department of Physics, Stanford University, Stanford, California 94305). *Phys. Rev. Lett.;* **41**: No. 15, 1005-1008(9 Oct 1978).

We have measured inclusive γ and π^0 production in multiprong events produced by e^+e^- annihilation in the center-of-mass energy range 4.9 to 7.4 GeV. We find that π^0 inclusive cross section to be consistent in shape and normalization with half the charged-π cross section between chi = 0.15 and 0.60, with an integrated inclusive cross-section ratio of $\sigma(\pi^0)$/ vertical-bar $(\sigma(\pi^+) + \sigma(\pi^-)$ vertical-bar = 0.47 +- 0.10.

9051 Proton—proton bremsstrahlung at small angles. Beveridge, J.L. (TRIUMF, Vancouver, British Columbia); Gurd, D.P.; Rogers, J.G. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 446-450(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

In principle nucleon-nucleon bremsstrahlung remains one of the most direct and least ambiguous ways of investigating the off-energy-shell behaviour of the NN interaction. Model calculations, such as that by Heller, indicate that in the symmetric Harvard geometry the off-shell effects are largest for high bombarding energies and small proton opening angles. Heller's calculation also shows that for the particular model and geometry he used, off-shell effects are fairly small for the conditions of previous experiments. Thus motivated ppy cross sections were measured at a somewhat higher bombarding energy (200 MeV) and over proton angles significantly smaller than in previous experiments. Two sets of data taken covering intervals centered at 13 and 16.3°, respectively. Preliminary results from the 16.3° data are reported here.

9052 Nucleon—nucleon bremsstrahlung experiments. Jovanovich, J.V. (Univ. of Manitoba, Winnipeg). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 451-476(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The present status of recent bremsstrahlung experiments and their comparison with theoretical calculations is reviewed. A significant disagreement with predictions based on the Hamada—Johnston potential is observed. It is also pointed out that experimental techniques exist which would make it possible to perform very accurate and comprehensive bremsstrahlung experiments.

WEAK INTERACTIONS

REFER ALSO TO CITATION(S) 9057

9053 (COO—3064-8) Present status of inelastic and elastic hadronic weak neutral currents. Mann, A.K. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 1977. Contract EY-76-C-02-3064. 43p. (CONF-7710107—5). Dep. NTIS, PC A03/MF A01.

From Conference on parity nonconservation, weak neutral currents and gauge theories; Batavia, IL, USA (20 Oct 1977).

Since the first observations of weak neutral currents in the reactions ν/sub μ/(anti ν/sub μ/) + nucleon → ν/sub μ/(anti ν/sub μ/) + hadrons in 1973, there have been a number of additional measurements of those reactions, and also of the elastic reactions ν/sub μ/(anti ν/sub μ/) + p → ν/sub μ/(anti ν/sub μ/ + p. The methods utilized are briefly compared and the results obtained are summarized. Inferences are drawn from these results concerning the space-time structure and scale invariance of the hadronic weak neutral current. 23 references.

9054 Rates and properties of opposite-sign dimuons from neutrinos and antineutrinos. Benvenuti, A.; Bobisut, F; Cline, D.; Cooper, P.S.; Gilchriese, M.G.D.; Heagy, S.M.; Imlay, R.; Johnson, M.; Ling, T.Y.; Lundy, R.; Mann, A.K.; McIntyre, P.; Mori, S.; Reeder, D.D.; Rich, J.; Stefanski, R.; Winn, D.R. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Phys. Rev. Lett.;* **41**: No. 18, 1204-1207(30 Oct 1978).

Measured energy-dependent rates of opposite-sign dimuons produced by neutrinos and antineutrinos are presented and used to determine the fraction of strange quarks. Experimental distributions are compared with those expected from charm production and decay.

9055 Cross-section measurements for the reactions $\nu p \to \mu^- \pi^+ p$ and $\nu p \to \mu^- K^+ p$ at high energies. Bell, J.; Berge, J.P.; Bogert, D.V.; Cence, R.J.; Coffin, C.T.; Diamond, R.N.; DiBianca, F.A.; Endorf, R.; French, H.T.; Hanft, R.; Harris, F.A.; Jones, M.; Kochowski, C.; Louis, W.C.; Lynch, G.R.; Malko, J.A.; Marriner, J.P.; Moffatt, G.I.; Nezrick, F.A.; Peters, M.W.; Peterson, V.Z.; Roe, B.P.; Ross, R.T.; Scott, W.G.; Seidl, A.A.; Smart, W.; Stenger, V.J.; Stevenson, M.L.; Velde, J.C.V.; Wang, E. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Phys. Rev. Lett.;* **41**: No. 15, 1008-1011(9 Oct 1978).

We present results for the reactions $\nu p \to \mu^- \pi^+ p$ and $\nu p \to \mu^- K^+ p$ at energies above 5 GeV. The average cross section for the first reaction between 15 ad 40 GeV is (0.80 +- 0.12) x 10^{-38} cm^2 and for events with M/sub π/+p-italic < 1.4 GeV is (0.55 +- 0.08) x 10^{-33} cm^2. The ratio of the cross section for the second reaction to that for the first is 0.017 +- 0.010.

9056 Study of the reactions $\nu p \to \mu^- \Delta^{++}$ at high energies and comparisons with theory. Bell, J.; Berge, J.P.; Bogert, D.V.; Cence, R.J.; Coffin, C.T.; Diamond, R.N.; DiBianca, F.A.; Endorf, R.; French, H.T.; Hanft, R.; Harris, F.A.; Jones, M.; Kochowski, C.; Louis, W.C.; Lynch, G.R.; Malko, J.A.; Marriner, J.P.; Moffatt, G.I.; Nezrick, F.A.; Peters, M.W.; Peterson, V.Z.; Roe, B.P.; Ross, R.T.; Scott, W.G.; Seidl, A.A.; Smart, W.; Stenger, V.J.; Stevenson, M.L.; Velde, J.C.V.; Wang, E. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Phys. Rev. Lett.;* **41**: No. 15, 1012-1015(9 Oct 1978).

We present production and decay distributions for the reaction $\nu p \to \mu^- p \pi^+$ with M/sub π/+/sub p/ < 1.4 GeV. This reaction is primarily $\nu p \to \mu^- \Delta^{++}$, but we find evidence for the presence of non-Δ amplitudes for $Q^2 > 1$ GeV^2. The data are fitted by various theoretical models. For $Q^2 < 1$ GeV^2 the best fit yields the value M/sub A/ = 1.25/sup +0.15//sub -0.13/ GeV, using a dipole-nucleon axial-vector form factor in Alder's model, although none of these models successfully reproduces the observed Δ-decay distributions.

STRONG BARYON-INDUCED INTERACTIONS

REFER ALSO TO CITATION(S) 9051, 9052, 9114, 9118

9057 (SLAC—214) **Measurement of the proton structure functions using inelastic electron scattering.** Mestayer, M.M. (Stanford Linear Accelerator Center, CA (USA)). May 1978. Contract EY-76-C-03-0515. 182p. Dep. NTIS, PC A09/MF A01.

Thesis.

Measurements of inclusive electron scattering cross sections from hydrogen are reported for beam energies between 6.5 GeV and 19.5 GeV and for electron scattering angles of 6, 10, 15, 18, and 20.6°. These measurements were taken using the Stanford Linear Accelerator and the 20 GeV spectrometer. Details of the experiment and the analysis are presented along with an estimate of the systematic errors on the cross section. The data were taken simultaneously (but not in coincidence) with similar measurements at 50 and 60° using the SLAC 1.6 GeV spectrometer, sharing beam target. By combining large angle data taken on the 1.6 GeV spectrometer with the data taken on the 20 GeV spectrometer, the proton structure functions sigma/sub L/ and sigma/sub T/ (or equivalently, νW_2 and $2MW_1$) were able to be separately determined. It was determined that data are consistent within systematic errors with earlier MIT-SLAC cross section measurements. A combined data set for the experiments was constructed. From the combined data set an average value of sigma/sub L//sigma/sub T/ = 0.21 +- 0.1 over the kinematic range covered, 3 GeV^2 < Q^2 < 18 GeV^2 and 4 GeV^2 < W^2 < 16 GeV^2 was determined. The dependence of sigma/sub L// sigma/sub T/ on different kinematic variables was studied. The Q^2 dependence was compared with theoretical predictions on quantum chromodynamics. The scaling behavior of the structure functions νW_2 and $2MW_1$ was investigated. The values of νW_2 and $2MW_1$ are evaluated along contours for which the scaling variables are constants. The Q^2 dependence along such contours is determined and agrees qualitatively with the predictions of asymptotically free gauge theories. 1 reference.

9058 **Measurement of np charge exchange for neutron energies 150—800 MeV.** Bonner, B.E.; Simmons, J.E.; Hollas, C.L.; Newsom, C.R.; Riley, P.J.; Glass, G.; Jain, M. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Phys. Rev. Lett.;* **41**: No. 18, 1200-1203(30 Oct 1978).

The s and u variations of the np charge-exchange (np → pn) cross section are measured to be relatively smooth and without structure at intermediate energies: in sharp contrast to previous results.

9059 **Direct electron-pair production in π^{+-} p interactions at 18 GeV/c.** Ballam, J.; Bouchez, J.; Carroll, J.T.; Chadwick, G.B.; Chaloupka, V.; Field, R.C.; Freytag, D.R.; Lewis, R.A.; Moffeit, K.C.; Stevens, R.A.; Band, H.; Fortney, L.R.; Glanzman, T.; Loos, J.S.; Robertson, W.J.; Walker, W.D.; Baker, P.A.; Dornan, P.J.; Gibbs, D.J.; Hall, G.; White, A.P.; Virdee, T.S. (Stanford Linear Accelerator Center, Stanford, California 94305). *Phys. Rev. Lett.;* **41**: No. 18, 1207-1210(30 Oct 1978).

With use of the Stanford Linear Accelerator Center hybride facility 1-m bubble chamber fitted with tantalum plates, a measurement was made of direct unexplained e^+e^- pair production in 18-GeV/c π^{+-}p interactions. Limits are set in π^+p processes. In π^-p a signal is observed which cannot be caused by eta, ω, or rho decay, and for masses > m/sub π/0, e^{+-}/π^{+-} = (0.87 +- 0.25) x 10^{-4}. Some properties of the events are discussed.

9060 **Analyzing power in the reactions p + d → d + p and p + p → d + π at GeV energies.** Biegert, E.; Carroll, J.; Dragoset, W. Jr.; Klem, R.; Lesikar, J.; Marshak, M.L.; McClelland, J.; Mulera, T.; Peterson, E.A.; Roberts, J.B.; Ruddick, K.; Talaga, R.; Wriekat, A. (Accelerator Research Facilities Division, Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev. Lett.;* **41**: No. 16, 1098-1101(16 Oct 1978).

We have used a polarized proton beam to measure the analyzing power for pd backward elastic scattering at incident kinetic energies of 0.68, 1.03, and 1.53 GeV and for the reaction p + p → d + π at 1.03 GeV. The data indicate that several mechanisms dominate pd backward elastic scattering over this energy range.

9061 **K^{*+-}(890) production in 205 GeV/c pp interactions.** Singer, R.; Fields, T.H.; Hyman, L.G.; Jaeger, K. (Argonne National Lab., Ill. (USA)); Kafka, T.; Pratap, M. (State Univ. of New York, Stony Brook (USA)); Voyvodic, L.; Walker, R.; Whitmore, J. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). *Nucl. Phys., B;* **135**: No. 2, 265-272(3 Apr 1978).

By use of data obtained from an exposure of the Fermilab 30-inch hydrogen bubble chamber to a 205 GeV/c proton beam, $K^0\pi^{+-}$ correlations and the inclusive production of K*(890) have been studied. Based on an analysis of the K^0sub(S)π^{+-} effective mass distribution, 95% confidence level upper limit of 0.22 K^{*+-}(890) per inelastic event is found. Possible systematic effects in the experimental determination of the rho° production rate due to the Kπ correlation are discussed. The result for K* production at √s = 19.7 GeV is incompatible with that obtained in a recent ISR experiment at √s = 53 GeV.

9062 **Nucleon—nucleon interactions, 1977.** Measday, D.F.; Fearing, H.W.; Strathdee, A. (eds.). New York; American Institute of Physics (1978). 590p. (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The conference included 46 papers, nine of which appeared previously in ERA. Separate abstracts were prepared for 37 papers. (JFP)

9063 **Nucleon—nucleon interaction: low energy experiments.** Haeberli, W. (Univ. of Wisconsin, Madison). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 1-18(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The results of recent low energy nucleon—nucleon scattering are summarized. New p-p cross section experiments below 20 MeV have resolved some of the inconsistencies in earlier cross section data and lead to a low energy behavior of the ^{3}P/sub c/ phase shift combination consistent with the analysis of higher energy data. Accurate polarization measurements in p-p scattering permit a model independent determination of all p-wave phase shifts at 10 MeV. New measurements of the n-p cross section at 50 MeV resolve an inconsistency in the $^1P_1$ phase shift at that energy. New n-p polarization measurements near 25 MeV and measurements of the spin correlation parameter at 50 MeV resolve the problem of the low energy behavior of the S-D coupling parameter epsilon$_1$. Other types of experiments related to the nucleon—nucleon interaction are also mentioned, i.e., study of the three-body problem and of the deuteron D-state.

9064 **Triple scattering parameters.** Edgington, J.A. (Queen Mary Coll., London). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 19-34(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Measurements, made at TRIUMF, of triple scattering parameters in proton—proton and neutron—proton elastic scattering are described.

9065 **Elastic np scattering.** Dieterle, B.D. (Univ. of New Mexico, Albuquerque). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 35-49(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Elastic differential cross sections for neutron—proton scattering in the range 200 to 1000 MeV are reviewed. Recent high statistics, backward-angle experiments at Saclay and LAMPF are in agreement, but disagree with previous measurements from PPA and Dubna. With few exceptions, data come from older, lower statistics experiments done with poor quality neutron beams. The study of neutron—proton interactions requires more high rate measurements of complete angular distributions, which can be performed using recently developed accelerator facilities. Preliminary measurements at LAMPF of 800 MeV np scattering at back angles and forward angles are presented. The latter is the first such high statistics experiment at medium energies.

9066 **Measurement of P,D,R, and A parameters at small angles for p—p elastic scattering at 310, 390, and 490 MeV.** Besset, D. (Univ., Geneva); Do, Q.H.; Favier, B.; Greeniaus, G.; Hess, R.; Lechanoine, C.; Rapin, D.; Werren, D.W.; Weddigen, Ch. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 50-85(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

An experiment for the determination of the Wolfenstein parameters P, D, R and A in p—p elastic scattering in an angular domain covering the Coulomb interference region was running at SIN. Preliminary results are presented at 310, 390 and 490 MeV incident kinetic energy for 2 < or = theta/sub lab/ < or = 8°. These are in fair agreement with the phase shift predictions.

9067 **Proton—proton scattering from 0.35 to 1.0 MeV.** Thomann, Ch.; Benn, J.E.; Muench, S. (Univ., Zurich). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 86-90(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Experimental cross section data of the elastic proton—proton scattering in the range from 0.35 to 1 MeV having an absolute accuracy of 0.2% are presented. Included are angular distributions for the determination of the effective range parameters and absolute cross section values around the interference minimum. (JFP)

9068 **Neutron—proton measurement and phase shift analyses near 50 MeV.** Fitzgerald, D.H. (Univ. of California, Davis); Johnsen, S.W.; Brady, F.P.; Garrett, R.; Romero, J.L.; Signell, P. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 91-95(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Measurements of n-p scattering observables at 50 MeV, most notably the recent measurement of the spin-correlation parameter, A/sub yy/, were obtained. This measurement is sensitive to the phase shift parameters epsilon$_1$ and delta($^1P_1$), for which early phase shift analyses gave poorly determined or "unphysical" values. The results of measurements are incorporated in a phase shift analysis to determine current best-fit values of 50 MeV n-p phase shifts.

9069 Nucleon—nucleon interactions at Fermilab energies. Franzini, P. (Columbia Univ., New York). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 96-116(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The experimental results on p—p scattering at Fermilab for sigma/sub total/, sigma/sub elastic/, sigma/sub inelastic/ and sigma/sub diffractive/ are synthesized. Their implications, as well as that of the future data inputs on the fundamental structure of the proton, are discussed.

9070 pp → dπ^+ near threshold. Jones, G. (Univ. of British Columbia, Vancouver). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 292-304(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The p + p → d + π^+ reaction was studied over a range of proton energies from 305 to 425 MeV. The pions were detected (in a single arm experiment) using a 50 cm broad-range Browne-Buechner magnetic spectrograph. Measurements of the differential cross section and analysing power for the reaction (determined by measurements of the pion azimuthal asymmetry resulting from the use of a polarized beam) enabled the contribution of d-wave pion production in this energy range to be clearly discerned.

9071 Single and double pion production in proton—proton collisions at medium energies. Bevington, P.R. (Case Western Reserve Univ., Cleveland). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 305-313(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The current status of knowledge of pion production from proton-proton collisions at medium energies is reviewed briefly. New measurements at 800 MeV are reported for both single- and double-pion production. The momentum spectra for single-pion production are compared to existing models. The magnitude of the integrated cross section for double-pion production indicates that there is no anomalously high yield near threshold as there is in neutron-proton collisions.

9072 Possible evidence for narrow bound states related to the p anti p system. Pavlopoulos, P. (CERN, Geneva); Backenstoss, G.; Bluem, P. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 340-356(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The exceptionally narrow, high mass nonstrange bosons clustered around the nucleon-antinucleon threshold are studied using a method based on the observation of monenergetic gamma rays accompanying the annihilation of stopped antiprotons in liquid hydrogen, where the anti p forms an antiprotonic atom with the target proton. In this way bound states were observed in the anti pp system for the first time. Three narrow structures at energies of 183, 216, and 420 MeV were seen with a confidence of 1, 2.5, and 1.8% respectively. The spectra are shown. Also applying the same methods to the anti p - He the case structure was found with 365 +- 26 MeV energy and 7.2% confidence. This would imply the formation of a bound state inside of nuclear matter. 47 references. (JFP)

9073 Bremsstrahlung in the p—d system at low energy. Roy, R. (Univ. Laval, Quebec); Rioux, C.; Slobodrian, R.J.; Frois, B. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 524-525(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Bremsstrahlung cross sections were measured for the p-d system at three deuteron bombarding energies. The energies were 6.3, 6.6 and 6.9 MeV at the center of the target. The measurements go through the threshold region and the data show interesting variations. Experimental cross sections seen are corrected for noncoplanarity. They are much larger than the measurements above the three body threshold for asymmetrical angles. 5 references. (JFP)

9074 Experiments on spin dependence at very high energy. Marshak, M.L. (Univ. of Minnesota, Minneapolis). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 118-131(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

Recent measurements of spin-dependent parameters in strong interactions. The focus of the review is those measurements which suggest the possible behavior of these parameters in future experiments at very high energy.

STRONG MESON-INDUCED INTERACTIONS

REFER ALSO TO CITATION(S) 9070, 9071, 9072, 9074

9075 Inclusive studies of D-meson decays at the psi (3772). Vuillemin, V.; Feldman, G.J.; Feller, J.M.; Fong, A.; Barbaro-Galtieri, A.; Ely, R.; Gobbi, B.; Hanson, G.; Jaros, J.A.; Kwan, B.P.; Lecomte, P.; Litke, A.M.; Lueke, D.; Madaras, R.J.; Miller, D.H.; Parker, S.I.; Peruzzi, I.; Piccolo, M.; Pun, T.P.; Rapidis, P.A.; Ronan, M.T.; Ross, R.R.; Scharre, D.L.; Trippe, T.G.; Yount, D.E. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). *Phys. Rev. Lett.;* **41**: No. 17, 1149-1152(23 Oct 1978).

We have measured charged multiplicities, inclusive branching ratios to states containing kaons, and average energy fractions in charged and neutral particles for decays of D mesons produced at the psi (3772) resonance. The average charged multiplicity is 2.3 +- 0.3 for both the neutral and the charged D. We find inclusive branching ratios B ($D^0 \rightarrow K^{+-}X$) = 0.35 +- 0.10 and B ($D^+ \rightarrow K^-X$) = 0.10 +- 0.07 for decays into charged kaons.

9076 Production and decay of a high-mass I = 3/2 baryon enhancement in 10.3 GeV/c π^+p interactions. Zemany, P.D.; Beaufays, J.; Goddard, M.C.; Key, A.W.; Merdjanian, H. (Toronto Univ., Ontario (Canada). Dept. of Physics); Kennedy, C.N. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Physics); Gordon, H.A.; Lai, K.W. (Brookhaven National Lab., Upton, N.Y. (USA)). *Nucl. Phys., B;* **137**: No. 4, 365-376(29 May 1978).

A high-mass Δ resonance is observed in several final states from π^+p interactions at 10.3 GeV/c. We obtain fitted mass and width values for this structure of 1871 +- 22 MeV and 205 +- 43 MeV, respectively. The branching ratios for decays to π^+p, pπ^+ π^0, nπ^+ π^+ and Σ^+K^+ are found to be 0.48 +- 0.15, 0.26 +- 0.07, 0.24 +- 0.07 and 0.03 +- 0.01, respectively. The Δrho, Δω differential cross sections and the rho^0 density matrix elements are examined.

9077 Investigation of azimuthal correlations in π^-p interactions at 40 GeV. Azimov, S.A.; Aliev, F.K.; Kulakhmedov, N.N.; Yuldashbaev, T.S. (Physicotechnical Institute of the Uzbek Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 499-502(5 May 1978).

Investigation of the reactions $\pi^-p \rightarrow px^{-1}$ have revealed azimuthal correlations of dynamic origin in the missing-mass interval 3.6<M/sub x/< or =4.8 GeV.

9078 Reaction $\pi^-p \rightarrow$etan at large momentum transfer. Apel, W.D.; Augenstein, K.; Bertolucci, E.; Vincelli, M.L.; Donskov, S.V.; Inyakin, A.V.; Kachanov, V.A.; Quaglia, M.; Krasnokutsky, R.N.; Kruger, M.; Leder, G.; Manelli, I.; Mikhailov, Y.V.; Muller, H.; Prokoshkin, Y.D.; Pierazzini, G.M.; Sergiampietri, F.; Sigurdson, G.; Scribano, A.; Toropin, A.N.; Schneider, H.; Shuvalov, R.S. (Joint Experiment of the Institute for High Energy Physics (Serpukhov, USSR) and the European Organization for Nuclear Research (Geneva, Switzerland)). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 82-83(Jan 1978).

Differential cross sections of the reaction $\pi^-p \rightarrow$etan are measured at the pion momentum 40 GeV/c. The experiment is performed at the 70-GeV IHEP accelerator. About 120 000 eta→2γ decays were registered. A 648-channel hodoscope spectrometer online with a computer was used to measure coordinates and energies of the γ rays. The differential cross section decreases exponentially with the square of the 4-momentum transfer ~exp (8t) at—t< or ≈1 (GeV/c)^2. However, another behavior ~exp (2t) is observed at higher momentum transfer 1< or ≈—t< or ≈ 5 (GeV/c)^2.

9079 Dependence of the mean squares of transverse momenta of π^{+-} mesons on the multiplicity of secondary charged particles in π^-p and π^-n interactions at p=40 GeV/c. Angelov, N.; Grishin, V.G.; Tsivtsivadze, E.T. (Joint Institute for Nuclear Research). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 84-85(Jan 1978).

Semi-inclusive distributions in transverse momentum of π^{+-} mesons produced in π^-p and π^-n interactions at 40 GeV/c are used to check the prediction of the multiperipheral model regarding the behavior of the slopes of the spectra dσ/sub n//dk/sub perpendicular/^{2}.

9080 Incoherent production of rho^0 mesons on nuclei by 3.7-GeV/c π^- mesons. Aref'ev, A.V.; Bayukov, Y.D.; Efremenko, V.I.; Zaitsev, Y.M.; Korotkikh, V.L.; Kuleshova, L.N.; Leksin, G.A.; Lipkin, I.M.; Semenov, A.V.; Surin, V.P.; Suchkov, D.A.; Fedorov, V.B.; Fominykh, B.A.; Khasanov, F.M. (Institute of Theoretical and Experimental Physics, State Atomic Energy Commission). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 85-91(Jan 1978).

Results are presented of an investigation of incoherent rho^0-meson production on the nuclei C, Al, Cu, and Pb and of rho^0-

meson production on hydrogen by π^- mesons with momentum 3.7 GeV/c. The mass, width, diffraction-peak slope, and density-matrix parameters of the rho^0 meson depend little on the atomic number of the nucleus. The A-dependence of the effective proton number is satisfactorily described within the framework of incoherent production of particles on nuclei. The rho^0 meson—nucleon interaction cross section was found to be σ/sub rhoN/=27.6 +- 4.5 mb.

9081 Diffractive dissociation in $\pi\pi$ collisions. Azimov, S.A.; Til, E.A.; Ustyugin, Y.E. (Physico-Technical Institute, Academy of Sciences of the Uzbek SSR). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 91-93(Jan 1978).

π^-n collisions with slow recoil protons (25<T< 400 MeV) and four relativistic charged particles were chosen in order to search for single-stream π-meson diffractive dissociation on a virtual π meson in emulsion exposed to 17 and 45 GeV/c π^- mesons. Correlations of the diffractive type are found using the asymmetry factor g_1 in the quasirapidity distribution of relativistic charged particles.

9082 Charged-particle multiplicities in pion-nucleus interaction in nuclear emulsions at 200 GeV/c. Anon(Alma-Ata—Gatchina—Moscow—Tashkent Collaboration). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 98-101(Jan 1978).

Experimental data on charged-particle multiplicities and their correlations in pion—nucleus interactions at 200 GeV/c are presented. The parameters describing low-energy data and with data on pA interactions at the same energy. The multiplicities are weakly energy dependent and exhibit KNO scaling, the scaling function being the same for primary pions and protons.

9083 Partial inelasticity coefficients in π^- ^{12}C interactions at p/sub π/-=40 GeV/c. Angelov, N.; Ivanovskaya, I.A.; Kanarek, T.; Lyubimov, V.B.; Mel'nikova, N.N.; Solov'ev, M.I.; Suleimanov, M.; Tuvdendorzh, D. (Joint Institute for Nuclear Research). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 101-103(Jan 1978).

We have determined the average fraction of energy transferred to π^+, π^-, and π^0 mesons in π^- ^{12}C interactions at p/sub π/-=40 GeV/c (partial inelasticity coefficients). These fractions turned out to be close to those obtained for π^-p interactions at the same primary-meson energy and independent of the number of slow protons observed in the interaction. The distribution of π^- ^{12}C events in the partial inelasticity coefficients is given. The question of the energy balance in π^- ^{12}C interactions is discussed.

PARTICLE INTERACTIONS AND PROPERTIES - THEORETICAL

GENERAL

REFER ALSO TO CITATION(S) 9150

9084 K/sub S/ regeneration on electrons from 30 to 100 GeV/c: A measurement of the K^0 charge radius. Molzon, W.R.; Hoffnagle, J.; Roehrig, J.; Telegdi, V.L.; Winstein, B.; Aronson, S.H.; Bock, G.J.; Hedin, D.; Thomson, G.B.; Gsponer, A. (Enrico Fermi Institute, University of Chicago, Chicago, Illinois 60637). *Phys. Rev. Lett.;* **41**: No. 18, 1213-1216(30 Oct 1978).

The amplitude of K/sub S/ regeneration by electrons, f_{31}/sup e//k = -(α/3) < R^2 > (<R^2> is the K^0 charge radius), can be determined by comparing the rates of coherent (transmission) regeneration and of diffraction regeneration at $q^2 = 0$. We made a determination from 30 to 100 GeV/c, using a novel approach: Two distinct Pb regenerators, of optimized thicknesses, were exposed to a double beam, and interchanged every burst. We find <R^2> = -(0.054 +- 0.026) fm^2. The sign, magnitude, and p independence agree with predictions.

9085 Some astrophysical limitations on the axion mass. Vysotskii, M.I.; Zel'dovich, Y.B.; Khlopov, M.Y.; Chechetkin, V.M. (Institute of Applied Mathematics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 502-505(5 May 1978).

A comparison of the axion luminosity of the sun with the observed photon luminosity leads to the lower bound μ/sub a/> 25 keV. This bound can be raised to μ/sub a/>200 keV by resorting to modern ideas concerning the structure of supergiants.

9086 Experimental sessions: Ann Arbor workshop. Chamberlain, O.; Marshak, M.L. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 20-34(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

Possible high energy spin dependence experiments of the future are considered including sizeable spin effects already seen, possible polarized beams above 12 GeV, jets, specific ideas for experiments, inclusive and elastic processes, and required beams and targets. It is concluded that future theories can only be valid if they correctly explain the spin dependences of scattering processes as well as their differential cross sections. Polarization experiments on spin dependence are expected to be important, expensive, and difficult. (JFP)

9087 What is polarization. how to compare its measurement with beam and target and with colliding beams. Michel, L. (IHES, Bures-sur-Yvette, France). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 147-157(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

The symbolic conventions for spin paramters in high energy scattering experiments are set forth for elastic and pseudo-elastic scattering, one-particle inclusive reactions, and for total cross section measurements. (JFP)

9088 Convention for spin parameters in high energy scattering experiments. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 142-146(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

Various conventions for expressing spin parameters in high energy scattering experiments are set forth. (JFP)

9089 Open problems in the quark model. Morpurgo, G. (Univ., Genoa). pp 1-23 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

Some open problems of the quark model are presented in logical order from the clear and simple to the less understood. Conceptual and academic questions are considered among these. The classification of states, electromagnetic properties, semileptonic decays, the mass of the quark, Melosh-like transformations, covariant calculations, the quark and the parton models, the number of quarks, and saturation and confinement are treated. 23 references. (JFP)

ELECTROMAGNETIC INTERACTIONS

REFER ALSO TO CITATION(S) 9160, 9221

9090 20-plet of vector mesons. Khrushchev, V.V. (Institute of High Energy Physics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 505-506(5 May 1978).

It is assumed that the two resonances in the e^+e^- channel from the mass interval 3.68—4.42 GeV can be identified with two mesons from the SU (4) 20-plet. The ratios of the widths of the decay of these mesons to e^+e^- and the quantum numbers of the members of the 20-plet are obtained.

9091 Relativistic corrections to the charge form factor of the deuteron at large momentum transfers. Muzafarov, V.M.; Troitskii, V.E.; Shirokov, Y.M. (Institute of Nuclear Physics of the Moscow State University). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 507-510(5 May 1978).

An integral representation in terms of the phase shifts of triplet n-p scattering is used for the deuteron charge form factor G/sup d//sub c/. The relativistic corrections to G/sup d//sub c/ are completely accounted for. It is shown that they make an appreciable contribution to G/sup d//sub c/ at large momentum transfers. The possibility of neglecting the spin-flip effect is noted.

9092 Asymmetry of electron—positron pair production by circularly polarized photons. Kuznetsov, V.M.; Potylitsyn, A.P. (Institute for Nuclear Physics, Tomsk Polytechnic Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 79-81(Jan 1978).

We consider pair production by circularly polarized photons in the Coulomb field of a nucleus and in a monocrystal field (the latter case is calculated in the Born approximation). The asymmetry coefficients of pair production are calculated for both cases and the possibility of using this process to determine the degree of circular polarization of high energy photons is considered. It is shown that for this purpose in the case of a monocrystal it is sufficient to measure the asymmetry of the angular distribution of only one component of the pair.

9093 Proton—proton bremsstrahlung at 730 MeV and the Low theorem. Nefkens, B.M.K. (Univ. of California, Los Angeles). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 477-481(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

A recent proton-proton bremsstrahlung experiment is discussed, and the results are presented more clearly using the soft-photon approximation based on the Low theorem. 8 references. (JFP)

9094 Bounds on the model dependence of the ppγ amplitude. Bohannon, G.E. (Massachusetts Inst. of Tech., Cambridge). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 494-501(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Bounds on the magnitude of the external emission pp bremsstrahlung amplitude are derived, assuming the nucleon-nucleon potential to be independent of energy. Similar bounds on the order k electric internal emission amplitude are briefly discussed. Numerical results are shown for the upper and lower bounds on the cross section computed from the convection current part of the external emission amplitude at 42 MeV and 200 MeV.

9095 Proton—proton bremsstrahlung. Szyjewics, A.; Kamal, A.N. (Univ. of Alberta, Edmonton). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 502-505(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

A field theoretic calculation of ppγ is presented. Strong interactions are taken into account to second order. Apart from the contribution of OBE external emission, the contributions of the ω-radiative-decay process and Δ excitation are calculated.

9096 Some comments on the soft-photon approach to proton—proton bremsstrahlung. Fearing, H.W. (TRIUMF, Vancouver, British Columbia). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 506-514(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

General features of proton-proton bremsstrahlung as obtained from soft-photon calculations are discussed, and numerical results of such calculations are compared with data from the TRIUMF, Manitoba, and UCLA experiments.

9097 New program for bremsstrahlung studies. Liou, M.K. (Brooklyn Coll.). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 516-523(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Photon emission accompanying the scattering of two particles A and B: A(q/sub i//sup μ/) + B(P/sub i//sup μ/ → A(q/sub f//sup μ/ + B(P/sub f//sup μ/) + γ(K/sup μ/) is considered. Here, q/sub i//sup μ/(q/sub f//sup μ/) and P/sub i//sup μ/(P/sub f//sup μ/) are the initial (final) four-momenta of particles A and B, respectively, and K/sup μ/ is the four momentum of the emitted photon. The bremsstrahlung cross section can be expressed as a function of the five independent variables. The choice of these five kinematical variables is strongly influenced by experimental considerations. Two most typical geometries used in bremsstrahlung experiments are the Harvard geometry and the Rochester geometry. Soft-photon expansion and the soft-photon theorem are discussed; and a comparison is made between the Howard and Rochester cross sections. 9 references. (JFP)

9098 Soft electromagnetic bremsstrahlung in inelastic hadronic collisions at high and intermediate energies. Rueckl, R. (Univ. of California, Los Angeles). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 526-532(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Electromagnetic bremsstrahlung in hadronic collisions was studied extensively at low and intermediate energies. It was found that the infrared divergent term of the cross section describes the data well up to surprisingly large photon energies. Using essentially the same soft photon approximation, production of low mass-low energy electron pairs via internal conversion of soft virtual bremsstrahlung accompanying the production of charged hadrons in hadron-hadron collisions at very high and intermediate energies. The resulting electron yields explain, at least in part, the direct electrons with small transverse momenta seen at the ISR, and are in no contradiction to the rates observed at LAMPF.

9099 Electromagnetic transitions of nucleon resonances, constituent quark theory, and the Melosh—Gilman—Kugler—Meshkov parametrization. Moorhouse, R.G. (Glasgow Univ.). pp 25-38 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

A background talk is given on radiative nucleon transitions for a comparison of the constituent quark model theory and the Melosh-Gilman-Kugler-Meshkov parametrization. Also considered are radiative transitions with virtual photons, γ/sub v/ + N → N* (coming from data on $e^- + N \rightarrow e^- + N + \pi$) where the Melosh transformation is silent, but the existing quark model gives some evidence true and some false. The N* → Nγ amplitudes from partial wave analysis of γN → πN, single quark transition multipoles, Melosh transformation parameterization and naive quark model calculations, and form factors are treated. 32 references. (JFP)

9100 Current quarks and constituent-classification quarks: some questions and ideas. Close, F.E. (CERN, Geneva). pp 137-166 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

A brief introduction is given to the spin dependence of inelastic photo and electroproduction. Parton model predictions of Kuti and Weisskopf are then criticized and a paradox noted in connection with a sum rule of Bjorken. The resolution of this paradox raises several questions concerning the constituent and current quark approaches to resonance excitation. Particular attention is given to current algebra constraints, angular momentum in the nucleon, the x → 1 behavior of inelastic electroproduction, psi production and radiative decays.

WEAK INTERACTIONS

9101 Decay of a charmed meson into a heavy lepton, and the mass of the ν/sub tau/ neutrino. Rekalo, M.P. (Physicotechnical Institute, Ukrainian Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 555-557(20 May 1978).

The probabilities of the decay of the pseudoscalar charmed F and D mesons into a heavy lepton, $F^- \rightarrow$tau$^-$ +nu-bar/sub tau/ and $D^- \rightarrow$tau$^-$ +nu-bar/sub tau/ are estimated under the assumption that the mass of the ν/sub tau/ neutrino is less than 220 and 58 MeV, respectively. At almost all values of m (ν/sub tau/) (up to 219.5 MeV) the probability of the F→tau+ν/sub tau/ decay exceeds the probability of the F→μ+μ/sub ν/ decay. The branching ratio W ($F^+ \rightarrow$tau$^+$ ν/sub tau/)/W ($F^+ \rightarrow \mu^+$ ν/sub μ/) is determined only by the mass of the ν/sub tau/ neutrino and is sensitive to this mass.

9102 Quark spectroscopy and Cabibbo angle. Filippov, A.T. (Joint Institute for Nuclear Research). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 566-569(20 May 1978).

On the basis of a modification of an idea by Weinberg and Fritzsch, a formula is derived for the Cabibbo angle θ/sub c/ in terms of the strong-interaction symmetry-breaking parameter r. The value θ/sub c/ ≅12.8° obtained from the stationarity condition dθ/sub C//dr =0 agrees well with the experimental value of θ/sub C/ and with the empirical masses of the structure quarks.

9103 General applicability of certain tests of the V-A theory of neutron decay. Garcia, A. *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 510-512(5 May 1978).

By directly applying the radiative-correction theorem to the angular coefficients in the neutron beta decay, it is shown that the recently proposed relations for verifying the V-A theory of this decay are generally valid in a variety of cases.

9104 Anomalous statistics and deep-inelastic neutrino interactions. Vladimirskii, V.V. (Institute of Theoretical and Experimental Physics, State Commission on the Use of Atomic Energy). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 109-110(Jan 1978).

Preferential production of uu-bar pairs in the proton and dd-bar pairs in the neutron can occur in the anomalous statistics of partons. We discuss the possibility of observing this asymmetry in the isotropic behavior of the y distributions for deep-inelastic antineutrino scattering.

STRONG INTERACTIONS, GENERAL

REFER ALSO TO CITATION(S) 9129

9105 Summary of the theory group. Low, F.E. (Massachusetts Inst. of Tech., Cambridge). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 35-40(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

This report will be divided into general remarks on three subjects: (1) high p/sub perpendicular to/ signatures of the underlying hadronic process, (2) some reminders of general spin dependence properties, and (3) a discussion of polarimetry; followed by a report of some miscellaneous calculations done by members of the group.

9106 Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977). 324p. (CONF-7509205—). $29.50.

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

Separate abstracts were prepared for the 13 papers presented. (JFP)

9107 Relativistic quark equations, instantaneous interactions and quasi-potentials. Moorhouse, R.G. (Glasgow Univ.). pp 225-238

of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

In constituent quark model calculations with noncharged quarks, the effective quark mass is small of the order of 300 or 400 MeV which is the order of the internal momenta of the quarks in such calculations. There is thus a need for at least the investigation of relativistic equations, involving such a quark mass in the first place for mass spectrum calculations. This problem is considered. The Salpeter and quasi-potential equations for mesons, wave functions for 0^{-1} and 1^{-1} mesons, and potentials and solution methods are studied. A few applications are mentioned. 15 references. (JFP)

9108 Formulation of relativistic hadron couplings. Mitra, A.N. (Univ. of Delhi). pp 239-248 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

It is noted that the quark-pair-creation hypothesis appears as an intrinsically more attractive candidate than the radiation quantum hypothesis for providing a more comprehensive framework for hadron couplings. The essential features of the calculations using each method are described. For a comparison among the alternatives, the total decay widths of a radially excited meson and of an orbitally excited meson each decaying into a pair are studied. A critical discussion of the results is given. 20 references. (JFP)

9109 Quark dynamics in the SLAC bag model. Giles, R.C. (Stanford Univ., CA). pp 249-279 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

An indication of the properties of states in the bubble model is given, and some of the theoretical problems involved in such an extended semi-classical model are discussed. Beginning with a conventional classical field theory of interacting quarks and a scalar, it is shown that in the case of strong coupling extended thin shell bound states form. A classical canonical theory of these bubbles is extracted from the theory. Some exact and approximate semi-classical solutions to the bubble equations of motion and their implications for the hadronic spectrum in the bubble model are discussed. Some of the problems of quantization of the canonical theory and its qualitative modifications to the semi-classical picture of the states are considered. In particular, the quantum theory of a single bubble in $2 + 1$ space-time dimensions where the classical theory is exactly solvable and its quantization is therefore straightforward is treated. A clarification of the grounds on which it is hoped that there may be a simple and attractive description of hadron dynamics in terms of quarks bound to an extended object is obtained. 20 references. (JFP)

9110 Descriptions of hadronic structure. Nambu, Y. (Univ. of Chicago). pp 281-292 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

The evolution of the quark model and the problem of quark confinement are discussed in this lecture. Some of the prominent ideas considered are color, charm, flavor, particle interactions, their relation to various SU groups, and various arguments for confinement of quarks including the color gluon gauge fields, the Abelian model system, the bag theories, and a proposed new calculation for confinement. 22 references. (JFP)

STRONG INTERACTIONS, BARYON NO.=0

REFER ALSO TO CITATION(S) 9108, 9127, 9128

9111 Description of the 9.5-GeV dimuon enhancement by means of a vector meson family with hidden "beauty". Gershtein, S.; Likhoded, A.K.; Pirogov, Y.F. (Institute of High Energy Physics, Serpukhov). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 103-108(Jan 1978).

The dimuon enhancement at the invariant mass M=9.5 GeV observed in recent FNAL experiments is described by means of a narrow vector meson family with hidden "beauty". It is shown that the cross section for production of these mesons is in accord with quark-parton model calculations. Some arguments are given in favor of the fact that the dimuon yields of the new ground state and excited states are of the same order, in contrast with the suppression of the psi' dimuon yield with respect to the psi dimuon yield. The possible diffractive production of the new vector mesons and particles with explicit "beauty" in neutrino experiments, electro-and photoproduction is discussed.

9112 Results on $\pi\pi$-scattering. Ochs, W. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 326-339(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The main facts which have led to present understanding of single pion production and the $\pi\pi$-scattering amplitude are reviewed.

9113 Deuteron. Thomas, A.W. (TRIUMF, Vancouver, British Columbia). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 373-386(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Nucleon-antinucleon meson exchange forces are reviewed with emphasis placed on the most recent theoretical work. The potential model and the dual-quark model and baryonium are treated. 27 references. (JFP)

9114 Low energy nucleon—antinucleon interaction. Myhrer, F. (CERN, Geneva). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 357-372(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Nucleon-antinucleon exchange forces are considered. Mainly the most recent theoretical work is treated, but also some general experimental information is given. The potential model, the dual-quark model and baryonium are considered. 7 references. (JFP)

9115 Dynamics of the meson spectrum. Joos, H. (Deutsches Elektronen-Synchrotron DESY, Hamburg). pp 203-223 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

A dynamical interpretation of the mesons and their properties in the framework of a relativistic quark model is attempted. A critical review is given of the assumptions underlying the relativistic heavy quark model, and these are compared with some formal aspects of the SLAC-bag model. Also the question of chiral symmetry and PCAC is raised. 55 references. (JFP)

STRONG INTERACTIONS, BARYON NO.=1

REFER ALSO TO CITATION(S) 9125, 9134

9116 Double charge exchange of kaons in inclusive reactions. Tseren, C. (Joint Institute for Nuclear Research). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 124-128(Jan 1978).

A study is made of the inclusive reactions $K^+ + N \rightarrow K^- + X$ and $K^- + N \rightarrow k^+ + X$ involving double strangeness exchange of kaons. A model analogous to the single-pion exchange model is proposed to calculate the cross sections for these processes. It is shown that the cross sections for these processes are dominated by the resonance contributions. An eikonal estimate reveals that the cut contribution is small.

9117 Spectrum of baryonic states. Dalitz, R.H. (Oxford Univ.). pp 39-71 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

Patterns for baryonic states are considered in the three-quark model. With this model such states may be classified according to the permutation symmetry of their space wave function, as being symmetric, antisymmetric, or of mixed symmetry. A brief discussion is given on how the complicated patterns come about and on what elements of the harmonic-oscillator three-quark shell model they depend. Finally, consideration is given to the new spectroscopy. 39 references. (JFP)

STRONG INTERACTIONS, BARYON NO. GREATER THAN 1

REFER ALSO TO CITATION(S) 9062, 9093, 9094, 9095, 9096, 9098

9118 Secondary-particle correlations and clustering effects in proton-nucleus and pion-nucleus interactions at 200 GeV/c. Lepekhin, F.G.; Simonov, B.B. (Leningrad Institute of Nuclear Physics, USSR, Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 93-97(Jan 1978).

The problem of the search for correlations of secondary particles in multiple production processes is reconsidered. It is shown that the frequently used method of standard correlation functions provides an answer only regarding the existence of a statistical dependence of the probabilities of incidence of particles in various rapidity intervals, due to formal correlations which always exist between the columns of a histogram. The experimental data obtained in the Collaborations on study of p and π^- interactions with nuclei at 200 GeV/c in a dispersion analysis and an analysis using the

Smirnov-Cramer-Mises criterion definitely indicate a strong clustering of particles. We propose and use an algorithm for the direct search for isolated groups (jets) of particles in individual events. It is shown that in multiple production in p and π^- interactions with nuclei at 200 GeV/c the particles form narrow groups containing two, three, four, or five particles.

9119 Radiative capture of K-bar mesons by the deuteron and YN scattering lengths. Akhiezer, A.I.; Gakh, G.I.; Rekalo, A.P.; Rekalo, M.P. (Kharkov Physico-technical Institute, Ukrainian Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 115-119(Jan 1978).

A study is made of the radiative capture of negative kaons by the deuteron in the S state, $K^- + D \rightarrow Y + N + \gamma$, with allowance for the final-state interaction. An analysis is given of the sensitivity of the photon energy spectrum and the total probability for the processes $K^- + D \rightarrow \Sigma^- + p + \gamma$, $\Lambda + n + \gamma$ to the values of the parameters characterizing low-energy hyperon—nucleon scattering. The amplitudes for YN scattering and for the transition $\Sigma \rightarrow \Lambda$ are calculated in the effective-range approximation with allowance for the condition of two-channel unitarity of the S-matrix. The amplitudes for the processes $K^- + D \rightarrow Y + N + \gamma$ depend strongly on the model chosen to describe the amplitudes for radiative capture of the kaon by the nucleon, $K^- N \rightarrow Y\gamma$. Expressions are obtained for the polarizations of the hyperon and photon produced in this process.

9120 Transverse-momentum distribution of secondary hadrons in hA collisions. Voloshin, S.A.; Nikitin, Y.P. (Moscow Engineering Physics Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 119-124(Jan 1978).

An equation is obtained for the development of the parton—hadron cascade in a nucleus induced by interactions with hadrons of high energy (E> or ≈30—50 GeV), with allowance for the transverse motion of the secondary particles. This equation is used to study the distribution of secondary hadrons with respect to the transverse momenta k/sub perpendicular/ in the region of relatively small k/sub perpendicular/ (k/sub perpendicular/< or ≈ (1—2) <k/sub perpendicular/>/sub h/N). It is shown that for secondary hadrons with longitudinal momenta in the region k/sub parallel/ < or ≈2R<m²/sub perpendicular/> (where R is the nuclear radius and <m²/sub perpendicular/> is the mean-square transverse mass of a parton) the average transverse momentum of the hadrons grows with decreasing k/sub parallel/ and increasing R, but at a rate much slower than the growth in the number of effective interactions of the hadron in the nucleus.

9121 Elastic p⁴He and p-bar⁴He scattering in the quasi-eikonal model of the theory of complex angular momenta. Grigoryan, L.A.; Shakhbazyan, V.A. (Erevan Physics Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 138-139(Jan 1978).

The differential cross sections of the elastic p⁴He and p-bar⁴He scattering are calculated in the quasi-eikonal model of the theory of complex angular momenta for two values of the lab energy, E=24 and 50 GeV, in the momentum-transfer interval 0—0.5 (GeV/c)². The total cross sections of the two processes are also calculated for the energy region E=10—70 GeV. It is shown that the theoretical values of the differential elastic p⁴He scattering cross section at E=24 GeV are in good agreement with the experimental data of the Clermond—Ferran—Lyon—Strasbourg Collaboration (Second Internat. Conf. on Elementary Particles, Aix-en-Provence, France, 6—12 September 1973).

9122 NN phase shift analysis, K-matrix, and optimal polynomial theory. Rijken, T.; Signell, P.; Burt, T. (Michigan State Univ., East Lansing). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 130-134(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

A new phase shift analysis is discussed, and some results are given for pp and np scattering. An improvement over the standard method of phase shift analysis is presented by the inclusion of the cut for 4m²/sub π/ < or = t approximately < 45m²/sub π/. Unitarization is achieved through application of a K-matrix formalism where for the first time in NN, the "derivative amplitudes". The theoretical predictions for the peripheral waves are compared with the trends predicted by a new version of optimal polynomial theory (OPT). With the analysis described it is aimed at better determination of nonperipheral phase shifts and a smooth transition between peripheral and nonperipheral phases.

9123 Spin dependence of the nucleon—nucleon interaction. Kroll, P. (Univ. of Wuppertal, Ger.); Leader, E.; von Schlippe, W. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 135-139(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

By utilizing a dispersion theoretic calculation of the isospin zero helicity nonflip amplitude to supplement the experimental data, and by making physically reasonable assumptions about isospin one dominance of certain helicity flip amplitudes, a unique, stable set of amplitudes in the region -0.7 less than or equal to t less than or equal to -0.1 GeV² at P/sub L/ = 6 GeV was obtained. Further, it is demonstrated the importance of the phase of the nonflip amplitudes in understanding the large t beahvior of P, C/sub NN/ and C/sub SS/.

9124 An overview of the nucleon—nucleon interaction. Vinh Mau, R. (Univ., Paris). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 140-168(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

In another approach to the NN interaction which can be regarded as a synthesis of the previous ones, an attempt is made to develop a meson theory of nuclear forces that combines the best features of the field theoretical and one-boson exchange calculations. The method developed permits treatment without ambiguity of the exchange diagrams shown and takes into account in a realistic way the mesonic resonances with their observed masses and decay widths even when these widths are very large. It is clearly demonstrated that it is possible to derive quantitatively and unambiguously the nucleon-nucleon forces from the well established information on other independent hadronic processes. 45 references. (JFP)

9125 Role of the range of isobar potentials and of the NΔp-vertex in NN-scattering. Holinde, K.; Machleidt, R. (Institut fuer Theoretische Kernphysik, Bonn). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 190-194(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The effect of modifying the range of isobar potentials according to a prescription given in a recent paper by Durso, Jackson, Brown and Saarela is demonstrated for some important NN-scattering phase shifts. Compared to the common choice, this new (shorter) range reduces the isobar contribution by about 50%. Furthermore, the effect of the NΔ rho-vertex is studied. This contribution not only reduces the cutoff-dependence of the transition potential, but also strongly improves the fit of certain phase shifts. The consideration of both effects allows the use of cutoff-parameters in the transition potentials which are in a much more reasonable range than before. Finally the effect of going to the static limit is investigated in the isobar potential. It is shown that this effect is not negligible; however, the static limit seems to be a reasonable approximation provided (π + rho)-exchange is taken into account.

9126 Super soft core models of the N—N interaction. Sprung, D.W.L. (McMaster Univ., Hamilton, Ontario). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 209-223(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Weak local phenomenological potential models of the N-N interaction developed by the McMaster-Monteral-Orsay collaboration are described along with some applications.

9127 N—N GOBEP meson field theory. Green, A.E.S.; Ueda, T.; Riewe, F.E. (Univ. of Florida, Gainesville). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 224-227(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Non-relativistic N-N GOBEP models using phase parameters which incorporate new experimental data are updated. It is found that the fits of these models are substantially improved, giving increased creditability to the physics underlying GOBEP models.

9128 Dispersion treatment of the NN and anti NN forward scattering amplitudes. Dumbrajs, O. (Univ. of Helsnki). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 228-240(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

A review is given of the recent work on anlysis of the nucleon-nucleon and antinucleon-nucleon forward scattering amplitudes by means of dispersion relations.

9129 Nucleon—nucleon dynamics from variational matrix Pade approximants. Bessis, D.; Mery, P.; Turchetti, G.; Gammel, J. (CEN de Saclay, Gif-sur-Yvette, France). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 241-252(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The operator Pade approximant (O.P.A.) method in potential scattering is summarized and analyzed. The exact phase shifts are reproduced within 0.1% at any energy with no more than three mesh points. Rigorous results supporting this procedure are given. Next the extension of this procedure to Lagrangian field theories is discussed for strong interactions at low energy and the essentials of the techniques given. The Yukawa interaction is analyzed and then chiral effects and vector mesons are taken into account through the

nonlinear sigma model and a renormalizable ω interaction. The results obtained with only one mesh point corresponding to the physical momentum are reported. Phase shifts coupling constants and scattering lengths are calculated for NN interactions. 17 references (JFP)

9130 High energy proton—proton elastic scattering and multiple scattering model. Wakaizumi, S. (Hiroshima Univ.); Tanimoto, M. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 253-256(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The small slope beyond the second peak in p-p elastic scattering differential cross section measured at $\sqrt{s}$ = 53 GeV is shown, in the constituent multiple scatterng model, to indicate that the proton consists of a small number of valence constituents. The number turns out to be none other than three by imposing the requirement of translational invariance over the whole composite system (i.e. the proton).

9131 Nucleon—nucleon problems at intermediate energies. Furuichi, S. (Rikkyo Univ., Tokyo). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 257-268(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

Nucleon-nucleon scattering in the energy interval between 400 MeV and a few GeV are discussed. Firstly a transition character of such energy between the low and the high energy regions is mentioned. Then the usefulness of the method of phase shift analysis is examined. Evidence of the di-baryon resonance and similar structures are summarized, and models are presented for systematic understanding of these di-baryon structures. It is suggested that many di-nucleon resonances with broad width and high inelasticity are widely distributed in GeV-energy region.

9132 Three-nucleon potentials due to π, S, and ω and nuclear matter. Ueda, T.; Sawada, T.; Takagi, S. (Osaka Univ.). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 405-431(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The three-nuclear potentials due to π, S (isoscalar-scalar meson) and ω, which are exchanged between two nucleons via the third nucleon were divided. The binding energy per nucleon in nuclear matter is calculated using the three-nucleon potentials with the two-nucleon OBEP of Ueda and Green (UGI), and 0.4, 4.3 and -1.3 MeV found at k/sub f/ = 1.4 fm^{-1} for the net contributions from the three-nucleon potentials due to π, S and ω, respectively. The sum of the two- and three-nucleon potentials gives approximately correct binding energy at the normal density. However, its density dependence is such that it produces overbinding at higher density. To remove the difficulty, the possible importance of the Pauli principle effect in nuclear matter on the intermediate nucleons of an interacting two-pion pair, which is a part of the two-pion exchange potential is pointed out.

9133 Nucleon—nucleon bremsstrahlung. Bohannon, G.E. (Massachusetts Inst. of Tech., Cambridge). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 482-493(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The nucleon-nucleon bremsstrahlung amplitude through order k depends on the NN wave function within the strong interaction volume and on the two-body magnetic dipole moment, both of which are unknown. Meson exchange currents have been included by several authors to account for parts of the magnetic moment. The wave function is of major interest. It is shown that the cross section at E/sub L/ = 200 MeV is very sensitive to unitary transformations of the reid soft core wavefunction within 1.5 fm. Results are also shown at 42 MeV.

9134 Isospin bounds on πN and NN elastic polarizations at high energies. Bourrely, C. (CNRS, Marseille Cedex, France); Soffer, J.; Michel, L. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 178-181(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

Recent experimental results were obtained on eta N and NN elastic polarizations both at FNAL and CERN. As it is well known, isospin invariance implies some restrictions on these polarizations and it is felt that these old results should be reconsidered quantitatively, in particular, at the highest available energies.

PARTICLE INVARIANCE PRINCIPLES AND SYMMETRIES

GENERAL

REFER ALSO TO CITATION(S) 9000

APPLICATIONS TO ELECTROMAGNETIC AND WEAK INTERACTIONS

REFER ALSO TO CITATION(S) 9137

9135 $\mu \rightarrow e+\gamma$ decay and mixing of charged heavy leptons. Koval'chuk, V.A.; Rekalo, A.P. (Physicotechnical Institute of the Ukrainian Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 496-498(5 May 1978).

The mixing of charged heavy leptons is considered in the SU (3) x U (1) model of weak and electromagnetic interaction, and the probability of the $\mu \rightarrow e+\gamma$ decay is calculated.

9136 Weak interactions in multi-quark models. Barinov, N.U.; Volkov, G.G. (Institute of High Energy Physics, Serpukhov). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 111-114(Jan 1978).

Weak-interaction schemes based on the six-quark and eight-quark models are analyzed. Assuming that transitions of the type K^0 arrow-right-leftK-bar^0 are suppressed, possible relations between the currents of opposite chiralities are studied in a six-quark model with equal quark masses. A direct generalization of this scheme is given in the case of the eight-quark model, in which case the Cabibbo angle can be interpreted as a mixing parameter for the electron and muon quantum numbers.

APPLICATIONS TO STRONG INTERACTIONS

9137 Parity violating nucleon—nucleon interaction. McKellar, B. H.J. (Univ. of Melbourne, Parkville, Australia). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 432-442(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The difficulties in computing the parity violating nucleon-nucleon interaction from an underlying weak interaction theory are reviewed, and the extent to which the parameters of the interactions can be determined by the available data is discussed. A possible experiment in ^{21}Ne which can provide useful constraints on the parameters is outlined.

9138 Study of parity violation by neutron capture gamma rays. Cavaignac, J.F. (Institut des Sciences Nucleaires, Grenoble, France); Liaud, P.; Steinberg, R.; Vignon, B.; Jeenicke, E.; Wilson, R. *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 443-445(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

A program of studying parity violation by neutron capture is in progress at the Institute Laue-Langevin at Grenoble. A schematic of the experimental apparatus is presented and brief discription is given of its operation and performance. 8 references. (JFP)

9139 Current and constituent quarks: theory and practice. Hey, A.J.G. (Southampton Univ., Eng.). pp 93-136 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

The present status of SU(6)/sub W/ phenomenology is surveyed in detail. After a discussion of SU(6) multiplets in the baryon and meson spectra, some ideas underlying the construction of SU(6)/sub W/ decay models are reviewed. In particular, the approach to SU(6)/sub W/ invoking the Melosh transformation between current and constituent quarks is described, and also, more briefly, explicit harmonic oscillator quark model calculations. The relative successes of the predictions of these two approaches for both baryon and meson decays are discussed at length. Some interesting suggestions emerge concerning the missing meson multiplets.

9140 SU(6)-strong breaking: structure functions and small momentum transfer properties of the nucleon. Yaouanc, A.L.; Oliver, L.; Pene, O.; Raynal, J.C. (Univ. de Paris-Sud, Orsay, France). pp 167-194 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

Evidence for SU(6) breaking of the baryonic ground state, the connection between the quark model and the quark—parton model, the nucleon in a pure 56 at rest with relativistic quark motion, and SU(6) mixing (56, L = 0) + (70, L = 0) for the nucleon, without the small components effects, description of the F_2/sup en//F_2/sup ep/ behavior, and the neutron charge radius are treated. Gluons and

the q anti q sea are introduced, and final results given combining the various effects. Finally the distinction between constituent and current quarks is discussed with regards to its relevance. 48 references. (JFP)

FIELD THEORY

REFER ALSO TO CITATION(S) 9049, 9129

9141 (COO—1545-239) **Vacuum expectation values of Higgs scalars in a SU(2)/sub L/ X SU(2)/sub R/ X U(1) gauge model.** Kitazoe, T.; Mainland, G.B.; Tanaka, K. (Ohio State Univ., Columbus (USA). Dept. of Physics). 1978. Contract EY-76-C-02-1545. 12p. Dep. NTIS, MF A01.

Portions of document are illegible.

The vacuum expectation values of the Higgs scalars are determined within the framework of a six quark SU(2)/sub L/ x SU(2)/sub R/ x U(1) gauge model after the imposition of discrete symmetrics that are necessary in order to express the Cabibbo angle in terms of quark mass ratios and phases of the vacuum expectation values. Both real and complex solutions are found for the vacuum expectation values depending on the relative values of the parameters in the Higgs potential.

9142 **Questions of quark confinement and ambiguities in Coulomb gauge of Yang-Mills fields.** Abarbanel, H.D.I. (Fermi National Accelerator Lab., Batavia, Ill. (USA)); Bartels, J. (European Organization for Nuclear Research, Geneva (Switzerland)). *Nucl. Phys., B;* **136**: No. 2, 237-247(24 Apr 1978).

The ambiguities considered by Gribov in the formulation of Coulomb gauge in non-Abelian gauge theories are discussed and the division of gauge field space into a sector with a unique transverse gauge, a sector with a two-fold ambiguity in transverse gauge, etc. is reviewed. The authors argue in a semi-classical fashion that transitions between these sectors readily occur and discuss the connection with ideas of quark confinement in the Coulomb gauge. Because of these transitions it appears that the functional integral formulation of Coulomb gauge will be rather more complicated than expected in the past.

9143 **Critical exponents for the Reggeon quantum spin model.** Brower, R.C. (California Univ., Santa Cruz (USA)); Furman, M.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Moshe, M. (European Organization for Nuclear Research, Geneva (Switzerland)). *Phys. Lett., B;* **76**: No. 2, 213-219(22 May 1978).

The Reggeon quantum spin (RQS) model on the transverse lattice in D dimensional impact parameter space has been conjectured to have the same critical behaviour as the Reggeon field theory (RFT). Thus from a high 'temperature' series of ten (D=2) and twenty (D=1) terms for the RQS model the authors extrapolate to the critical temperature T=Tsub(c) by Pade approximants to obtain the exponents eta=0.238 +- 0.008, z=1.16 +- 0.01, γ=1.271 +- 0.007 for D=2 and eta=0.317 +- 0.002, z=1.272 +- 0.007, γ=1.736 +- 0.001, lambda=0.57 +- 0.03 for D=1. These exponents naturally interpolate between the D=0 and D=4-epsilon results for RFT as expected on the basis of the universality conjecture.

9144 **Leptons and quarks in the quaternion model.** Chkareuli, D.L. (Physics Institute, Georgian Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 557-561(20 May 1978).

A gauge theory is constructed for quaternion fields of spin 0, 1/2, and 1. It is shown that this theory is equivalent to the usual theory with spontaneously broken [SU (2) x U (1)]/sub loc/ x SU (2)/sub glob/ symmetry and to the isodoublet structure of the multiplets of material fields: fermions (quarks and leptons) and Higgs scalars; the GIM mechanism is realized in the theory in a natural fashion and CP-invariance is violated.

9145 **High orders of perturbation theory in the Yang-Mills model with scalar field.** Bukhvostov, A.P.; Lipatov, L.N.; Malkov, E.I. (B. P. Konstantinov Institute of Nuclear Physics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 561-565(20 May 1978).

In the model of a scalar field interacting with Yang-Mills fields, we investigate field configurations that make the largest contribution to the higher order of perturbation theory in the scalar-field interaction constant λ and in the Yang-Mills constant g. The contributions of these configurations to the expansion of the Green's functions is estimated.

9146 **Decreasing total cross section in Reggeon field theory with α (0) >1.** Raikin, M.S.; Ryskin, M.G. (Leningrad Institute of Nuclear Physics, USSR Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 129-131(Jan 1978).

It is shown that a consistent solution of the three-Pomeron interaction problem in Reggeon field theory in the lattice approximation (as was assumed in studies by the Amati group) leads to a power-law decrease of the total cross sections with increasing energy, even if the input is α (0) >1.

9147 **Vacuum transitions in the Neveu-Schwarz dual model.** Volkov, D.V.; Zheltukhin, A.A.; Pashnev, A.I. (Physico-Technical Institute of the Ukrainian Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 131-137(Jan 1978).

A system of integral equations is derived and solved for the Neveu-Schwarz dual amplitude, rearranged so as to account for vacuum transitions. An additional degeneracy in the resonance-state spectrum due to the hidden quark structure is demonstrated. An account of spontaneous vacuum transitions by means of an analytic continuation in the coupling constant of induced vacuum transitions results in the elimination of tachyons in the Neveu-Schwarz model and in the appearance of an exact SU (2) symmetry.

9148 **Eikonal approximation from the point of view of the interaction representation.** Andrianov, A.A. (Leningrad State University). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 149-154(Jan 1978).

A variable-phase equation prescribing a smooth correction of the eikonal approximation is constructed by means of the interaction representation. This equation is the origin of the eikonal-type quasi-classical approximation.

9149 **Okubo-Zweig-Iizuka rule in the dual model.** Demchenko, G.P. (Institute of Theoretical Physics, Ukrainian Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 154-155(Jan 1978).

The dynamical suppression of the hadronic decay of the Psi particle is investigated using a statistical approach to the dual model.

9150 **Null plane field theory and composite models.** Bell, J.S. (CERN, Geneva); Ruegg, H. pp 73-91 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

A sketch is given of an approach to null plane field theory which (it is hoped) illuminates the relation between the relativistic parton model, the nonrelativistic quark model, and various SU(6) and SU(6)/sub W/ broken symmetry schemes, including those of Melosh.

SCATTERING THEORY

9151 **Diffraction scattering and dependence of the jet-enchancement coefficients on the energy and on the momentum transfer.** Eremyan, S.S. (Erevan Physics Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 140-148(Jan 1978).

Diffraction scattering is investigated and it is shown that a correct description of the cross section of this process in the region of small masses M/sub x/ leads to a dependence of the vacuum-pole jet-enhancement coefficients on the energy and on the momentum transfer. This dependence leads in turn to a rapid growth of the total cross sections, in good agreement with the experimental data.

PHYSICS RESEARCH (CONT.)

NUCLEAR PHYSICS

9152 (ORO—1067-16) **Triangle Universities Nuclear Laboratory annual report: TUNL XVI, 1 January 1977—31 December 1977.** (Triangle Universities Nuclear Lab., Durham, NC (USA)). 1977. Contract EY-76-C-05-1067. 133p. Dep. NTIS, PC A07/MF A01.

A summary of research is presented on nuclear physics. Included in the studies are neutron and fission physics, neutron polarization studies, high resolution studies, gamma ray spectroscopy, charged-particle reactions with polarized beams, radiative capture reactions, atomic collision physics, heavy ion physics, the development of facilities, ion source development, accelerator development and instrumentation computer-related development, and nuclear theory and phenomenology. A list of publications is included. (JFP)

NUCLEAR PROPERTIES AND REACTIONS, A=1-

5, THEORETICAL

NUCLEAR REACTIONS AND SCATTERING

9153 Diffraction description of the two-particle disintegration of ^{3}He in noncoplanar geometry. Fursa, A.D.; Peresypkin, V.V. (Institute of Theoretical Physics, Academy of Sciences of the Ukrainian SSR). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 65-69(Jan 1978).

Experimental data on the reaction ^{3}He(p, 2p) d in noncoplanar geometry at 590 MeV is analyzed using the diffraction theory of multiple scattering, taking into account the isospin dependence of the nucleon—nucleon scattering amplitude. Model functions of the Gaussian type were used to describe the ground state of the ^{3}He and d nuclei. The wave function of the final state in the continuum, taking into account the final-state interaction of the reaction products with large relative energy, was chosen on the basis of Huygens' principle. The dependence of the reaction cross section on the parameters of the nucleon—nucleon scattering amplitude is analyzed and the role of the final-state interaction is explained. The significant role of effects related to the longitudinal momentum transfer is indicated. The theoretical calculations are in good agreement with the experimental data.

9154 Multiple pion scattering in the reaction $\pi+d\rightarrow 2N$ in the region of the Δ resonance. Braun, M.A.; Kallies, W.; Suslov, V.M. (Leningrad State University). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 72-78(Jan 1978).

The interaction of pions having lab momenta from 100 to 300 MeV with deuterons, followed by breakup of the deuteron, is considered. All the diagrams that describe multiple pion scattering are taken into account. It is assumed that the πN interaction proceeds via the (3,3) resonance. The recoil of the nucleons in the intermediate state are neglected. The calculations are performed for real particles with allowance for spin and isospin. The numerical calculation was carried out using three approximations for the deuteron wave function. Comparison with the experimental data is carried out for the total and differential cross sections.

NUCLEAR PROPERTIES AND REACTIONS, A=1-5, EXPERIMENTAL

NUCLEAR REACTIONS AND SCATTERING

9155 ^{3}He and ^{4}He form factors and the dimensional-scaling quark model. Chertok, B.T. (American University, Washington, D.C. 20016). *Phys. Rev. Lett.;* **41**: No. 17, 1155-1159(23 Oct 1978).

The large-q^2 behavior of new elastic electron-scattering measurements from ^{3}He and ^{4}He is compared with the dimensional-scaling quark model. The slope change in F3/sub He// F/sub quark/ for $q^2 > 2$ GeV^2 when compared to ^{2}H and ^{4}He is conjectured to be evidence for scaling permitting the further synthesis of nucleon-nucleon and quark-gluon physical ideas.

NUCLEAR PROPERTIES AND REACTIONS, A=6-19 THEORETICAL

MASS, ABUNDANCE, AND BINDING ENERGY

9156 Folding potentials and antisymmetrization. Schultheis, H.; Schultheis, R. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Phys. Rev. Lett.;* **41**: No. 15, 1020-1022(9 Oct 1978).

Antisymmetrization effects in the ^{16}O + ^{16}O heavy-ion potential and their dependence on the nulceon-nucleon interaction have been studied. It is shown that for some choices of nulceon-nucleon interaction the recently conjectured cancellation of antisymmetrization and polarization effects breaks down completely.

9157 Charge distribution in ^{16}O. Kamuntavicius, G.P. (Institute of Physics and Mathematics, Lithuanian Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 52-57(Jan 1978).

Various sets of basis states of the orthogonal scheme model (OSM) permit obtaining either the result of the translationally invariant shell model (TISM) or the minimal harmonics approximation (MHA) of the method of hyperspherical functions (MHSF) or the result of both models with inclusion of some higher harmonics. For various sets of such basis states and the six most frequently used potentials represented in the form of combinations of Gaussians, we have calculated the following characteristics of the ^{16}O nucleus: charge form factor, charge density distribution, rms radius, and binding energy. All of the results of the OSM are very close to those of the MHSF with the same number of harmonics included if the model parameter is chosen as the result of a variational procedure. It is shown that in the minimal harmonic approximation it is impossible to obtain the second diffraction minimum of the charge form factor in the momentum-transfer region investigated. This possibility appears already when four harmonics are taken into account with K=K/sub min/+2 and with the symmetric spatial Young diagrams, but it is not possible to reconcile the behavior of the entire curve even in this case.

RADIOACTIVE DECAY

REFER ALSO TO CITATION(S) 9159

ENERGY LEVELS AND TRANSITIONS

9158 ^{12}C-pion monopole scattering. Sparrow, D.A.; Gerace, W.J. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Phys. Rev. Lett.;* **41**: No. 16, 1101-1104(16 Oct 1978).

Inelastic pion excitation of the 0$^+$ (7.65-MeV) level in ^{12}C is studied using a Kisslinger optical potential in both a distorted-wave impulse approximation and a coupled-channels formalism. Inclusion of coupling through the first excited 2$^+$ state in ^{12}C causes a dramatic suppression of this cross section for pion energies below 75 MeV. This explains the unexpectedly small 0_1/sup ts+/ cross sections recently observed, and may permit detailed testing of pion-nucleus reaction theories.

9159 Energy dependent ft-value and B(M1) in ^{8}Be. Tomoda, T. (Tokyo Univ. (Japan). Dept. of Physics); Kubodera, K. (Argonne National Lab., Ill. (USA)). *Phys. Lett., B;* **76**: No. 3, 259-262(5 Jun 1978).

The strengths of the β- and the γ-decays leading to ^{8}Be(2$^+$; Esub(x) approximately equal to 3 MeV) are calculated as functions of the excitation energy of the broad final state. A microscopic continuum wave function is used. Comparison is made with the experimental data.

NUCLEAR REACTIONS AND SCATTERING

9160 Threshold pion photoproduction in ^{12}C and the 15.11 MeV M1 form factor. Haxton, W.C. (Los Alamos Scientific Lab., N.Mex. (USA)). *Phys. Lett., B;* **76**: No. 2, 165-169(22 May 1978).

Considerable improvements in the agreement between the Kroll-Ruderman prediction for ^{12}C(γ,π^-)^{12}Nsub(gs) and the measurements of Bernstein et al. (Phys. Rev. Lett., 37 (1976) 810) is obtained by using nuclear wave functions consistent with the present acknowledgement of the ^{12}C 15.11 MeV M1 form factor.

NUCLEAR PROPERTIES AND REACTIONS, A=6-19, EXPERIMENTAL

NUCLEAR REACTIONS AND SCATTERING

9161 Differential elastic and inelastic scattering of 7- to 15-MeV neutrons from beryllium. Hogue, H.H. (Duke Univ., Durham, NC); Von Behren, P.L.; Gould, C.R. *Nucl. Sci. Eng.;* **68**: No. 1, 38-42(Oct 1978).

Differential cross sections are reported for elastic and inelastic scattering of neutrons from beryllium. Source neutrons were provided by the anti D(anti d,n)^{3}He reaction at energies from 7 to 15 MeV in 1-MeV steps. Scattered neutrons were observed over a flight path of 4 m at angles ranging from 25 to 160 deg in 5-deg increments. The integrated elastic scattering cross sections agree well with the ENDF/B-IV cross-section set. The inelastic scattering cross sections are for the sum of the 1.69-, 2.43-, 2.8-, and 3.06-MeV-state cross sections, and fall below the ENDF/B-IV predictions. Inelastic scattering to the 2.43-MeV state in ^{9}Be accounts for less than half of the total ^{9}Be(n,2n) cross sections above 8 MeV. 5 figures, 1 table.

9162 Cross sections for reactions in ^{12}C, ^{14}N, and ^{16}O induced by 50-MeV protons with three charged particles in the final state. Golikov, I.G.; Zhukov, M.N.; Loshchakov, I.I.; Ostroumov, B.I. (Leningrad Polytechnic Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 3-4(Jan 1978).

An emulsion chamber bombarded by 50-MeV protons has been used to investigate reactions in the nuclei ^{12}C, ^{14}N, and ^{16}O. Cross sections are obtained for reactions with three charged particles in the exit channel.

9163 Mechanism of the (π^+,2p) reaction in ^{12}C, ^{16}O, and ^{14}N at 112 MeV. Gismatullin, Y.R.; Kosmach, V.F.; Martirosova, A.G.; Ostroumov, V.I. (M. I. Kalinin Leningrad Polytechnic Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 19-21(Jan 1978).

Experimental data on absorption of 112-MeV π^+ mesons by light emulsion nuclei are compared with calculations using the deuteron pole diagram for two regions of residual-nucleus momen-

tum. It is found that in the region of low recoil-nucleus momenta (< or ≈270 MeV/c) the main contribution is from pole processes over the entire range of excitation energies of the final nuclei. In the case of large momentum transfers to the nucleus the data are consistent with the assumption of a contribution of two-nucleon absorption with rescattering of one of the nucleons by the residual nucleus.

9164 Low-energy particles in nuclear reactions produced by nuclei with energies of 0.1—1 GeV/nucleon. Bogdanov, S.D.; Ostroumov, V.I. (Leningrad Polytechnic Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 69-71(Jan 1978).

Slow singly and doubly charged particles emitted in collisions of nonrelativistic cosmic-ray nuclei with emulsion nuclei are investigated. The set of results obtained indicate that the emission of low-energy particles in these interactions is due mainly to nonequilibrium processes.

NUCLEAR PROPERTIES AND REACTIONS, A=20-38, THEORETICAL

NUCLEAR REACTIONS AND SCATTERING

9165 (RLO—1388-378) **Large angle oscillations in heavy ion elastic scattering and continuum VMI rotational band structures.** Cramer, J.G. (Washington Univ., Seattle (USA). Dept. of Physics). 1977. Contract EY-76-C-06-1388. 20p. (CONF-771059—8). Dep. NTIS, PC A02/MF A01.

From Symposium on heavy-ion elastic scattering; Rochester, NY, USA (25 Oct 1977).

Analysis of "problem" angular distributions for $^{16}O + ^{28}Si$ elastic scattering over a range of energies gives evidence of a continuum band structure having an energy-vs.-spin dependence of [l(l + 1)]/sup 2/3/ which can be obtained from the variable moment of inertia (VMI) collective rotational model. This suggests a model for continuum resonances which is applied to elastic scattering data with some success. Other applications of the model are discussed.

9166 Analysis of neutron emission spectra from 14-MeV neutron reactions. Pearlstein, S. (Brookhaven National Lab., Upton, NY). *Nucl. Sci. Eng.;* **68**: No. 1, 55-60(Oct 1978).

Measured neutron emission spectra from 14-MeV neutron-induced reactions in a wide range of nuclei are analyzed by precompound-nucleus model calculations. The nuclear model code parameters are adjusted by use of a least-squares fitting procedure to optimize the agreement between calculation and experiment, but the parameters are constrained to physically reasonable values. A single set of input nuclear constants produces calculated spectra that agree to within 30% of experimental values in over 70% of the cases. 4 figures, 1 table.

NUCLEAR PROPERTIES AND REACTIONS, A=20-38, EXPERIMENTAL

NUCLEAR REACTIONS AND SCATTERING

9167 (NUREG/CP—0004(Vol.2), pp 959-967) **Reaction rate measurements and integral cross sections using the NBS ^{252}Cf fission neutron indoor irradiation facility.** Spiegel, V. (National Bureau of Standards, Washington, DC); Eisenhauer, C.M.; Grundl, J.A.; Martin, G.C. Jr. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

A fission source of ^{252}Cf has been developed especially for integral cross section determinations and reaction rate calibrations at the National Bureau of Standards (NBS). An irradiation program has been successfully completed utilizing the NBS ^{252}Cf standard fission spectrum indoor facility and the radioactivity counting laboratory at General Electric Company, Valecitos Nuclear Center (VNC). Certified fission neutron fluences for two irradiations of aluminum, iron, nickel, titanium, ^{235}U, ^{238}U, and ^{237}Np dosimeters were 6.6 x 10^{12} and 1.6 x 10^{13} n/cm^2. The cross sections reported are: ^{58}Ni(n,p)^{58}Co, ^{27}Al(n,α)^{24}Na, ^{46}Ti(n,p)^{46}Sc, ^{47}Ti(n,p)^{47}Sc, ^{48}Ti(n,p)^{48}Sc, ^{54}Fe(n,p)^{54}Mn, ^{238}U(n,f)^{140}Ba, ^{235}U(n,f)^{140}Ba, and ^{237}Np(n,f)^{140}Ba. This report describes the methods and results of this program. Reaction-rate cross sections inferred from the radioanalysis of the activation detectors include corrections for all nearby and remote scattering materials.

9168 Gamma-ray spectrum in coincidence with scattered pions from 190-MeV π^- reactions on ^{27}Al. Lind, V.G.; McAdams, R.E.; Otteson, O.H.; Denig, W.F.; Goulding, C.A.; Greenfield, M.; Plendl, H.S.; Lieb, B.J.; Stronach, C.E.; Gram, P.A.M.; Sharma, T. (Utah State University, Logan, utah 84322). *Phys. Rev. Lett.;* **41**: No. 15, 1023-1026(9 Oct 1978).

In a pion—γ-ray coincidence spectrum from 190-MeV π^- reactions with ^{27}Al, prominent lines are observed corresponding to the equivalent removal of ^{6}Li, α, t, d, p, and n. When the data are normalized to n removal and compared to the inclusive singles γ-ray data, pion-scattering cross sections on the order of (50—100) % of the total for these reactions are implied.

NUCLEAR PROPERTIES AND REACTIONS, A=39-58, THEORETICAL

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 9202

9169 Role of the exit-channel distorting potential in heavy-ion-induced inelastic scattering. Ascuitto, R.J.; Petersen, J.F.; Seglie, E.A. (Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06520). *Phys. Rev. Lett.;* **41**: No. 17, 1159-1163(23 Oct 1978).

The application of the distorted-wave Born approximation (DWBA) to inelastic scattering is examined. Particular attention is given to the $^{16}O + ^{40}Ca$ system. The one-channel optical-potential wave function is found to be an adequate representation of the entrance-channel relative motion. The choice of exit-channel distorting potential DWBA is found to be crucial and a procedure to choose it correctly is discussed.

NUCLEAR PROPERTIES AND REACTIONS, A=39-58, EXPERIMENTAL

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 9178

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 9167

9170 (NUREG/CP—0004(Vol.2), pp 953-957) **Measurement of threshold reaction cross section ratios in fission neutron fields.** Fleming, R.; Spiegel, V. (National Bureau of Standards, Washington, DC). 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

Direct measurement of ratios of cross sections were carried out in both ^{252}Cf and ^{235}U fission spectra. The results for the reactions ^{58}Ni(n,p)^{58}Co and ^{54}Fe(n,p)^{54}Mn are presented and compared with calculations based on the ENDF/B-IV data file.

9171 Quadrupole radiation in fast-neutron capture on ^{40}Ca. Wender, S.A.; Roberson, N.R.; Potokar, M.; Weller, H.R.; Tilley, D.R. (Physics Department, Duke University, Durham, North Carolina 27706). *Phys. Rev. Lett.;* **41**: No. 18, 1217-1220(30 Oct 1978).

Differential cross sections have been measured for the reaction ^{40}Ca(n, γ_0)^{41}Ca at seven angles in 1-MeV steps and at θ/sub lab/ = 90° in 200-keV steps for incident neutron energies of 6—13 MeV. The extracted a_2 coefficients and the fore-aft asymmetry are in good agreement with a direct-semidirect model calculation if the isoscalar giant quadrupole resonance is included.

NUCLEAR PROPERTIES AND REACTIONS, A=59-89, EXPERIMENTAL

RADIOACTIVE DECAY

9172 (n,α) reaction and a new region of α decay of compound states of nuclei. Antonov, A.; Balabanov, N.; Gledenev, Y.M.; Chol, P.H.; Popov, Y.P. (Joint Institute for Nuclear Research). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 9-14(Jan 1978).

Studies of the (n,α) reaction in resonance neutrons are analyzed in a new region of nuclei with A ~ 60—106. The existence of α decay of highly excited states in this region of spherical nuclei is established. The experimental α widths are compared with those calculated by the optical and cluster models. Values of the strength

function for soft γ transitions between the compound states are estimated.

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 9178

9173 Direct observation of elastic and inelastic photon scattering by the giant dipole resonance in ^{60}Ni. Bowles, T.J.; Holt, R.J.; Jackson, H.E.; Laszewski, R.M.; Nathan, A.M.; Specht, J.R.; Starr, R. (Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev. Lett.;* **41**: No. 16, 1095-1097(16 Oct 1978).

Monoenergetic photons and a high-resolution NaI spectrometer have been used to measure the absolute 120° scattering cross sections to the ground state and to the first excited state in ^{60}Ni for excitations between 15 and 22 MeV. The inelastic scattering to the first excited state was found to be about 15% of the elastic throughout this energy range. Our results do not appear to be in quantitative agreement with the predictions of the dynamic collective model.

9174 Multipolarity of continuum γ rays from enhanced angular correlation measurements. Deleplanque, M.A.; Byrski, T.; Diamond, R.M.; Huebel, H.; Stephens, F.S.; Herskind, B.; Bauer, R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Phys. Rev. Lett.;* **41**: No. 16, 1105-1108(16 Oct 1978).

We have studied the angular correlation of continuum γ rays in coincidence with an array of NaI counters following heavy-ion compound-nucleus reactions. This technique can both enhance the measured angular correlations and enrich the spectrum in high-angular-momentum events. The results extend previous ideas about the quadrupole bumps and exponential tails observed in such spectra, and reveal for the first time intense low-energy stretched dipole transitions in nuclei near closed shells.

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 9172, 9174

9175 Evidence for energy thermalization in deep-inelastic processes: ^{63}Cu + ^{20}Ne at 7.9, 12.6, and 17.2 MeV/nucleon. Schmitt, R.P.; Bizard, G.; Wozniak, G.J.; Moretto, L.G. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Phys. Rev. Lett.;* **41**: No. 17, 1152-1155(23 Oct 1978).

Light—charged-particle emission in the reaction ^{63}Cu + ^{20}Ne has been studied by simultaneously measuring the atomic numbers of both deep-inelastic fragments. The results seem consistent with an evaporative process and indicate that the entrance-channel kinetic energy is essentially thermalized over a broad range of bombarding energies.

9176 Investigation of inelastic-scattering spectra within the framework of the exciton model. Ezhov, S.N.; Plyuiko, V.A. (Kiev State University). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 62-65(Jan 1978).

A method based on the kinetic-equation formalism is proposed for a unified description of the statistical contribution to nuclear reactions. The spectra of neutrons inelastically scattered by ^{93}Nb and ^{59}Co are calculated. The results are compared with experiment.

NUCLEAR PROPERTIES AND REACTIONS, A=90-149, EXPERIMENTAL

REFER ALSO TO CITATION(S) 9166

RADIOACTIVE DECAY

REFER ALSO TO CITATION(S) 9172, 9190

9177 Displacement, induced by hyperfine interaction, of x-ray lines excited in internal conversion. Egorov, A.I.; Rodionov, A.A.; Ryl'nikov, A.S.; Sovestnov, A.E.; Sumbaev, O.I.; Shaburov, V.A. (B. P. Konstantinov Institute of Nuclear Physics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 483-485(5 May 1978).

A new effect has been observed experimentally, namely the energy shift of x-ray K lines excited in internal conversion of nuclear transitions. The effect is due to the interaction of the electron with the magnetic moment of the nucleus (hyperfine interaction: HI) under conditions of non-static component population determined by the spin selection rules, and can be used as a method of measuring the magnetic moments of nuclear states independently of their lifetimes.

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 9174

9178 (BNL—24742) **Survey of photon strengths from A = 20 to 240.** McCullagh, C.M.; Chrien, R.E. (State Univ. of New York, Stony Brook (USA); Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 3p. (CONF-780926—5). Dep. NTIS, PC A02/MF A01.

From 3. symposium on neutron capture of gamma-ray spectroscopy; Upton, NY, USA (18 Sep 1978).

E1 and M1 strength functions were derived from recent measurements and renormalization of existing data in the literature for the mass region A = 20 to 240. Comparisons with existing models were made. 2 figures.

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 8831, 8832

9179 (NUREG/CP—0004(Vol.2), pp 855-872) **Review of differential neutron data for important reactions not yet included in ENDF/B-V dosimetry file.** Vlasov, M.F. (International Atomic Energy Agency, Vienna); Okamoto, K.; Edvardson, L.; Schwerer, O. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

The present status of the excitation functions (differential-energy dependent cross sections) of 20 reactions important for reactor neutron fission and fusion dosimetry is given in graphical form with references. Brief discussion of integral-differential consistency is included. The IAEA nuclear data section activity aimed to establish an internationally recommended file of neutron data for dosimetry applications is briefly discussed.

9180 Yrast traps and very high-spin yrast states in ^{152}Dy. Khoo, T.D.; Smither, R.K.; Haas, B.; Haeusser, O.; Andrews, H.R.; Horn, D.; Ward, D. (Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev. Lett.;* **41**: No. 15, 1027-1030(9 Oct 1978).

We have identified yrast states of ^{152}Dy to spin ~37, with unusually strong population of high-spin states in the (^{32}S, 4nγ) reaction. Yrast isomers with spins ~17, 21, 27, and 31 were detected. For I > or = 14 the yrast states scatter about a straight line on an E vs I (I + 1) plot, consistent with predictions for aligned-particle configurations. The slope of the line yields an effective moment of inertia 18% larger than the rigid-sphere value. This and other arguments suggest possible oblate deformation at high spin.

9181 Fast-neutron capture cross sections for even-even isotopes of neodymium, samarium, gadolinium, and erbium. Kononov, V.N.; Yurlov, B.D.; Poletaev, E.D.; Timokhov, V.M. (Physics and Power-Engineering Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 5-8(Jan 1978).

Cross sections for neutron radiative capture for /sup 142,144,146,148,150/Nd, /sup 144,148,150,152,154/Sm, /sup 156,158,160/Gd, and /sup 166,168,170/Er have been measured in the energy region 5—350 keV by the time-of-flight method and with detection of prompt capture γ rays by a total-absorption scintillation detector. As a result of analysis of the experimental data in terms of the statistical theory of nuclear reactions, s-, p-, and d-wave neutron and radiative strength functions have been obtained.

9182 Possible experiments with polarized neutrons at the ZGS and at FNAL. Jones, L.W. (Univ. of Michigan, Ann Arbor). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 42, 158-172(1978). (CONF-7710115—).

From Workshop on polarized proton beams; Ann Arbor, MI, USA (18 Oct 1977).

Fundamental to the class of experiments discussed is the interference between the electromagnetic or magnetic scattering and the nuclear scattering. It is noted that polarization effects are maximal where these amplitudes are equal at a value determined by a relation for transverse momentum in elastic scattering. Some of the experiments discussed include the verification of the Schwinger effect, determination of the polarization, study of beam polarization, study of the change in cross sections, double scattering, and scattering on a polarized target. 12 references. (JFP)

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 9184

NUCLEAR PROPERTIES AND REACTIONS, A=150-189, EXPERIMENTAL

RADIOACTIVE DECAY

9183 (NUREG/CP—0004(Vol.2), pp 969-974) **Intercomparison of ^{152}Eu gamma-ray emission-rate measurements.** Debertin, K. 1977.

From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).

In Dosimetry methods for fuels, cladding, and structural materials.

An intercomparison of gamma-ray emission-rate measurements by means of germanium spectrometers and ^{152}Eu sources was organized by a working group of the International Committee for Radionuclide Metrology. Details on the performance of the intercomparison, on the evaluation procedure and on preliminary results are presented.

ENERGY LEVELS AND TRANSITIONS

9184 (BNL—24696) **Systematics of fragmentation of Nilsson strength near A = 190.** Casten, R.F.; Warner, D.D.; Cizewski, J.A. (Brookhaven National Lab., Upton, NY (USA); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France); State Univ. of New York, Stony Brook (USA)). 1978. Contract EY-76-C-02-0016. 3p. (CONF-780926—9). Dep. NTIS, PC A02/MF A01.

From 3. symposium on neutron capture of gamma-ray spectroscopy; Upton, NY, USA (18 Sep 1978).

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It is shown that the systematics of the fragmentation of Nilsson strength in the Hf—Os region can be understood in terms of varying quadrupole and hexadecapole deformations. 2 figures.

NUCLEAR PROPERTIES AND REACTIONS, A=190-219, EXPERIMENTAL

REFER ALSO TO CITATION(S) 9184

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 9178, 9184

9185 (BNL—24694) **Simple empirical method for determining the energy gap in nonspherical even—even nuclei.** Cizewski, J.A.; Casten, R.F.; Stelts, M.L. (State Univ. of New York, Stony Brook (USA); Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 5p. (CONF-780926—10). Dep. NTIS, MF A01.

From 3. symposium on neutron capture of gamma-ray spectroscopy; Upton, NY, USA (18 Sep 1978).

Portions of document are illegible.

It is shown that the energy gap in nonspherical even—even nuclei is rather sharply delineated in γ-ray spectra following average resonance neutron capture. The relation to other methods of determining the energy gap is also presented.

9186 (CONF-780926—14) **Localized dipole and quadrupole radiation strengths in ^{208}Pb.** Raman, S. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 29p. Dep. NTIS, PC A03/MF A01.

From 3. symposium on neutron capture of gamma-ray spectroscopy; Upton, NY, USA (18 Sep 1978).

This review summarizes the existing experimental situation regarding the M1, E1, M2 and E2 γ-ray strengths from individual states of ^{208}Pb to the ground state. The (n,γ) and (γ,n) reaction studies have contributed significantly in determining the strengths in the 7.37- to 10.2-MeV region. Theoretical calculations of these strengths are also briefly discussed. 10 figures, 7 tables.

NUCLEAR REACTIONS AND SCATTERING

9187 **Nucleon transfer reactions in interaction of 220-MeV ^{40}Ar ions with ^{197}Au.** Artyukh, A.G.; Volkov, V.V.; Gerlik, E.; Gerstenberger, R.; Gridnev, G.F.; Zlokazov, V.B.; Mezentsev, A.N.; Mikheev, V.L.; Salamatina, T.S. (Joint Institute for Nuclear Research). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 14-18(Jan 1978).

We have bombarded ^{197}Au by ^{40}Ar ions with energy 220 MeV, corresponding to an excess over the interaction barrier by 1.15 times. The ΔE, E technique has been used to record the formation of particles with atomic numbers 11< or =Z< or =35. It is shown that for multinucleon transfer reactions realized in deep inelastic collisions of nuclei, the angular distributions are directed forward. In few-nucleon transfer reactions the form of the angular distributions depends on the degree of dissipation of the initial kinetic energy.

NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, EXPERIMENTAL

ENERGY LEVELS AND TRANSITIONS

REFER ALSO TO CITATION(S) 9178, 9188

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 9167, 9209

9188 **Multilevel resonance parameters of ^{241}Pu.** Weston, L.W.; Todd, J.H. (Oak Ridge National Lab., TN). *Nucl. Sci. Eng.;* **68**: No. 1, 125-128(Oct 1978).

The data previously reported by the authors on the neutron fission and capture cross sections of ^{241}Pu were simultaneously fit with the Adler formalism to obtain multilevel resonance parameters. The neutron energy range of the fit was 0.01 to 100 eV. The ^{241}Pu cross sections in the resonance region of neutron energies are complex, and the Adler parameters present an efficient method of representing these cross sections, which are important for plutonium-fueled reactors. The parameters represent the data to an accuracy within the quoted experimental errors. 5 figures, 2 tables.

9189 **Emission of conversion muons in radiative fission of uranium nuclei by muons.** Belovitskii, G.E.; Batusov, Y.A.; Sukhov, L.V. (Nuclear Research Institute, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 11, 625-627(5 Jun 1978).

Direct experimental proof of the existence of muon conversion in nonradiative fission of uranium nuclei is obtained. Some of the quantitative characteristics of this fission are estimated.

SPONTANEOUS AND INDUCED FISSION

REFER ALSO TO CITATION(S) 9188

9190 (NUREG/CR—0349) **Calorimetric fission product decay heat measurements for ^{239}Pu, ^{233}U, and ^{235}U.** Yarnell, J.L.; Bendt, P.J. (Los Alamos Scientific Lab., NM (USA)). Aug 1978. Contract W-7405-ENG-36. 25p. (LA—7452-MS). Dep. NTIS, PC A02/MF A01.

A fast-response cryogenic boil-off calorimeter was used to measure decay heat from the products of thermal fission of ^{239}Pu, ^{233}U, and ^{235}U. Data are presented for cooling times between 20 and 10^5 s following a 2 x 10^4-s irradiation at constant thermal neutron flux. The experimental uncertainty (1 sigma) was 3 to 4% for ^{239}Pu, approximately 5% for ^{233}U, and approximately 2% for ^{235}U. The average percent deviation of the experimental data points from summation calculations using the ENDF/B-IV data base was +9.7% for ^{239}Pu, +4.2% for ^{233}U, and +0.5% for ^{235}U. The agreement between experiment and calculation is satisfactory except in the case of ^{239}Pu, where the deviation exceeds the combined uncertainties in the experiment and the calculation. The difference between experiment and summation calculation for ^{239}Pu is believed to be significant, but its source has not been identified. 4 figures, 12 tables.

9191 **Measurement of the ^{238}U to ^{235}U fission cross-section ratio for neutron energies between 0.1 and 25 MeV.** Difilippo, F.C.; Perez, R.B.; de Saussure, G.; Olsen, D.K.; Ingle, R.W. (Oak Ridge National Lab., TN). *Nucl. Sci. Eng.;* **68**: No. 1, 43-54(Oct 1978).

The ^{238}U to ^{235}U fission cross-section ratio was measured for incident neutrons from 0.1 to 25.0 MeV. A ratio shape measurement was normalized by the threshold cross-section method. A fission cross-section ratio of 0.436 +- 0.004 was found averaged over neutron energies from 2.35 to 2.95 MeV. 8 figures, 12 tables.

9192 **Measurement of the fission cross section of ^{241}Pu relative to ^{235}U for neutron energies from 1 keV to 30 MeV.** Carlson, G.W.; Behrens, J.W. (Univ. of California, Livermore). *Nucl. Sci. Eng.;* **68**: No. 1, 128-132(Oct 1978).

The fission cross-section ratio of ^{241}Pu was measured relative to ^{235}U over the neutron energy range from 1 keV to 30 MeV at the Lawrence Livermore Laboratory 100-MeV Linac. Ionization fission chambers and the time-of-flight technique were used to take data simultaneously over the entire energy range and obtain a measurement of the shape versus the neutron energy of the ratio accurate to +-2% over most of the energy range. Two independent methods determined the normalization of the shape measurement. 2 figures, 4 tables.

9193 Searches for the formation of superdense nuclei in fission. Borovoi, A.A.; Klimov, Y.V.; Kopeikin, V.I.; Mikaelyan, L.A.; Shkol'nik, K.D. (I. V. Kurchatov Institute of Atomic Energy). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 494-495(5 May 1978).

A search is carried out for superdense nuclei produced in fission and whose decay is accompanied by the emission of high-energy β particles. It is established that at an energy E/sub β/>20 MeV the electron yield does not exceed 2 x 10^{-8} per event of fission of californium-252.

9194 Parity violation in fission. Danilyan, G.V.; Vodennikov, B.D.; Dronyaev, V.P.; Novitskii, V.V.; Pavlov, V.S.; Borovlev, S.P. (Institute of Theoretical and Experimental Physics, State Commission on Use of Atomic Energy). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 21-27(Jan 1978).

The P-odd asymmetry of emission of the light fragment (and correspondingly of the heavy fragment) along the direction of and opposite to the spin of the captured neutron has been measured in fission of ^{235}U and ^{239}Pu by polarized thermal neutrons. The asymmetry coefficients turned out to be a (^{236}U) = (1.50 +- 0.44) x 10^{-4} and a (^{240}Pu) = (-4.8 +- 0.8) x 10^{-4}.

9195 Search for near-threshold asymmetrical fission of bismuth by α particles. Kuks, I.M.; Nemilov, Y.A.; Nikolaev, V.A.; Selitskii, Y.A.; Funshtein, V.B.; Vylkov, N.; Itkis, M.G.; Okolovich, V.N. (V. G. Khlopin Radium Institute). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 28-31(Jan 1978).

By measuring the spectra of the diameters of fragment tracks in glass detectors, it was established that ^{213}At most probably fissions symmetrically for excitation energies 1—3 MeV above the barrier, and that the contribution of the component of asymmetric fission does not exceed 1%. The most probable fragment energies are 67 +- 3, 67 +- 2, and 71 +- 2 MeV for E/sub b/=28, 29, and 30 MeV, respectively.

9196 Structure of fragment mass distributions in fission of ^{235}U and ^{239}Pu by thermal neutrons, and in the spontaneous fission of ^{252}Cf and ^{240}Pu. Zamyatnin, Y.S.; Basova, B.G.; Ryazanov, D.K.; Rabinovich, A.D.; Korostylev, V.A. *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 31-35(Jan 1978).

We report two-dimensional measurements of the kinetic energies of coincident fragments from fission of ^{235}U and ^{239}Pu by thermal neutrons and the spontaneous fission of ^{252}Cf and ^{240}Pu, obtained by means of a double ionization chamber. In the mass distributions of a heavy fragment in coincidence with a light fragment having a high kinetic energy, an increased yield was observed of fragments corresponding to masses 128 +- 1, 134 +- 1, 140 +- 1, 144 +- 1, 151 +- 1, and 156 +- 1 amu. A correlation was observed between the average number of neutrons emitted by heavy fragments and the structure of their yield.

NUCLEAR THEORY

NUCLEAR STRUCTURE

REFER ALSO TO CITATION(S) 9000, 9124, 9126

9197 Characteristic shape of nuclei. Smirnov, Y.F.; Filippov, G.F. (Institute of Theoretical Physics, Ukrainian Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 39-44(Jan 1978).

The inertia-ellipsoid principal-axis coordinate system is used to study the shape of the nucleon density distribution and quadrupole deformations in nuclei. The effective asphericity and effective nonaxiality of light nuclei are calculated in the translationally invariant shell model. It is shown that p and sd-shell nuclei, including magic nuclei, have a considerable effective deformation in the principle-axis frame.

9198 Self-consistent description of the Fermi surface in doubly magic nuclei. Birbrair, B.L.; Glezer, S.I.; Lapina, L.P.; Sadovnikova, V.A. (Leningrad Nuclear Physics Institute of the USSR Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 45-49(Jan 1978).

The Fermi surfaces and the nucleon and charge distributions of doubly magic nuclei are calculated using the fully self-consistent potentials. The potentials are based on the effective interaction and determined in the Hartree approximation. The results are compared with the calculations of Ref. 1, which used a partially self-consistent potential and also with the existing Hartree-Fock calculations. They are in a reasonable qualitative and quantitative agreement with the experimental data.

9199 Inclusion of the continuum in the thermodynamical calculation of the shell correction in nuclei. Zavarzin, V.F.; Kolomiets, V.M.; Ofengenden, S.P. (Institute for Nuclear Research, USSR Academy of Sciences). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 49-52(Jan 1978).

The role of the quasidiscrete continuum states is considered in the calculation of the shell correction to the nuclear binding energy in realistic potential wells of finite depth. It is shown that when a potential of finite depth is used a stable calculation of the shell correction using both the thermodynamical method and the Strutinsky method requires that continuum states be taken into account. As an example, it is shown that for the ^{208}Pb nucleus using the Woods-Saxon potential the thermodynamical method of calculating the shell correction is less sensitive to the extent of the continuum than the Strutinsky method is.

9200 Phase-equivalent nonlocal potentials. Sauer, P.U. (Technical Univ., Hanover). *AIP (Am. Inst. Phys.) Conf. Proc.;* No. 41, 195-208(1978). (CONF-770674—).

From Nucleon-nucleon interaction meeting; Vancouver, Canada (27 Jun 1977).

The construction and application of nonlocal potentials equivalent with respect to the experimental two-body data and to the theoretical knowledge on the exterior of the nuclear force are discussed. Constraints on the nonlocality are given.

NUCLEAR MATTER

REFER ALSO TO CITATION(S) 9132

9201 Structure of π condensate in nuclear matter. Berezovoi, V.P.; Chudnovskii, E.M. (Khar'kov State University). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 491-493(5 May 1978).

An exact solution is obtained for the equations of the quasiclassical model of π condensation. The numerical smallness of the amplitude of the π condensate admits of its existence at normal nuclear density.

NUCLEAR REACTIONS AND SCATTERING

REFER ALSO TO CITATION(S) 9221

9202 Calculation of nuclide distributions in deep inelastic scattering and the production of neutron rich nuclei. Braun-Munzinger, P. (State Univ. of New York, Stony Brook (USA). Dept. of Physics); Barrette, J. (Brookhaven National Lab., Upton, N.Y. (USA)). *Nucl. Phys., A;* **299**: No. 1, 161-174(17 Apr 1978).

Nuclide distributions for deep inelastic fragments are calculated considering the diffusion of the intermediate dinuclear system in a two-dimensional liquid drop potential energy surface. Particle decay from the fragments is taken into account by statistical model calculations. The concept of charge equilibration is investigated. Calculations are compared to previously measured nuclide distributions. Predictions are made for production cross sections of neutron-rich nuclei in deep inelastic reactions.

9203 Possibilities of obtaining relatively cool compound nuclei with high angular momenta. Tarantin, N.I. (Joint Institute for Nuclear Research). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 57-62(Jan 1978).

A simple classical model for the fusion of two nuclei is used to analyze the possibilities of obtaining relatively cool compound nuclei with large angular momenta in reactions of heavy ions on nuclei. It is shown that compound nuclei can be formed with a critical angular momentum determined by the entrance channel to the reaction and with thermal energy lower than B/sub i/+Q, where B/sub i/ is the interaction barrier and Q is the energy released when the compound nucleus is formed.

SPONTANEOUS AND INDUCED FISSION

9204 Possible unified description of nuclear collisions and fission. Shigin, V.A. (I. V. Kurchatov Institute of Atomic Energy). *Sov. J. Nucl. Phys. (Engl. Transl.);* **27**: No. 1, 35-38(Jan 1978).

It has been shown [V. A. Shigin, Yad. Fiz. 3, 756 (1966); Yad. Fiz. 14, 695 (1971)] that a system of two touching nuclei is comparatively stable against disintegration and fusion, and relatively unstable to random exchange of nucleons between nuclei which could result in significant changes in nuclear dimensions. These properties of touching nuclei were at the root of a proposed fission mechanism in which a light nucleus (an α particle) is formed on the periphery of the compound nucleus and increases in size because of nucleon transfer and the subsequent disintegration of the nucleus. We have produced a potential relief map on which this type of fission can be traced, and have estimated the system lifetimes for disintegration, fusion, nucleon exchange, and changes in nuclear dimensions. It is shown that the basic facts observed in nuclear collisions are consistent with the notion that the behavior of colliding nuclei after coming together is determined by the same potential relief map and nucleon

exchange treated here. A compound nucleus is formed in this process when nucleons are transferred from one nucleus to the other.

RADIATION AND SHIELDING PHYSICS

9205 Monte Carlo aspects of contributons. Dubi, A.; Gerstl, S.A.W.; Dudziak, D.J. (Los Alamos Scientific Lab., NM). *Nucl. Sci. Eng.;* **68**: No. 1, 19-30(Oct 1978).

A method to calculate volumetric distributions of contribution flux and contribution current is developed which utilizes only the forward Monte Carlo approach. Various aspects of tracking contributions are discussed. Basically, the new method consists of sampling secondary particles at collision points occurring within a prespecified volume. A simple connection between integrals over that volume and surface integrals of contribution current is derived; thus, a means of calculating integral detector responses by means of a volume integration of the contribution current is obtained. A considerable improvement of the effectiveness with which deep-penetration radiation transport problems can be solved relative to analog Monte Carlo methods thereby results. A theoretical and numerical comparison of the performance of this new method with the performance of analog Monte Carlo techniques is carried out. Numerical results are discussed, and a theoretical model to predict the relative advantage of the new method is found to give satisfactory answers. If no biasing techniques are employed in either method, the sample problems show that the contribution method can save up to 90% of computing time over the conventional Monte Carlo method in deep-penetration problems in computations of an integral response with the same target accuracy. 5 figures, 2 tables.

RADIATION PHYSICS

9206 Electron pickup by fast ions in solids. Cross, M.C. (Bell Lab., Murray Hill, NJ). pp 253-281 of Inelastic ion-surface collisions. Tolk, N.H.; Tully, J.C.; Heiland, W.; White, C.W. (eds.). New York; Academic Press, Inc. (1977).

From Bell Labs. IWIISC conference; Murray Hill, NJ, USA (28 Jul 1976).

The theory of electron pickup by fast protons in solids is reviewed. The important physics involved has not been well discussed in the literature. It is shown here that the charge states for high energy protons may be simply understood in terms of capture into and subsequent loss from bound states on the proton within the solid. Collective screening and the short lifetime of the bound state are not important. The surface does not play an important role. For high enough proton velocities, capture and loss cross sections for single atoms may be directly transferred to the solid. The solid behaves as a gas scaled to higher densities. A comparison with other theories is given, and the intermediate energy range is briefly discussed.

NEUTRON INTERACTIONS WITH MATTER

REFER ALSO TO CITATION(S) 8138, 8146, 9025

9207 (LA—7475-MS) Application of artificial intelligence techniques to the acceleration of Monte Carlo transport calculations. Maconald, J.L.; Cashwell, E.D. (Los Alamos Scientific Lab., NM (USA)). Sep 1978. Contract W-7405-ENG-36. 75p. Dep. NTIS, PC A04/MF A01.

The techniques of learning theory and pattern recognition are used to learn splitting surface locations for the Monte Carlo neutron transport code MCN. A study is performed to determine default values for several pattern recognition and learning parameters. The modified MCN code is used to reduce computer cost for several nontrivial example problems.

9208 Neutron scattering and absorption by laser photons in crystals. Agranovich, V.M.; Lalov, I.I. (Inst. of Spectroscopy, Moscow). pp 329-340 of Theory of light scattering in condensed matter. Bendow, B.; Birman, J.L.; Agranovich, V.M. (eds.). New York; Plenum Press (1976).

From Soviet-American symposium on theory of light scattering in solids; Moscow, USSR (26 May 1975).

The cross section for the scattering of neutrons by photons is high in crystals. Since a photon in a crystal (polariton), being a superposition of transverse photon, and Coulomb excitations (optical phonon, exciton, etc.), excites during its propagation the motion of the nuclear subsystem, the cross section for scattering of neutrons by photons turns out to be proportional to the neutron scattering cross section for nuclei and the phonon strength function at the polariton frequency. Analytical expressions for neutron cross sections are derived, and numerical estimates are made. 2 figures. (RWR)

9209 Probability table method and correlated data. Pearlstein, S. (Brookhaven National Lab., Upton, NY). *Nucl. Sci. Eng.;* **68**: No. 1, 10-18(Oct 1978).

The probability table method (PTM), used in unresolved-resonance-region calculations, assumes that cross sections are not energy correlated. Strong cross-section energy autocorrelations are noted for some heavy nuclides that could affect the use of the PTM in the unresolved-resonance region or its extension to the resolved-resonance region. Uranium-238 has strong cross-section autocorrelations and is considered a severe test material for the PTM. Monte Carlo calculations of capture rates in ^{238}U at 500, 1000, and 2000 eV do not show differences between the PTM and exact methods within an approximately 1% calculational uncertainty. These results show that strong autocorrelations do not interfere with the use of the PTM in the resolved- and unresolved-resonance regions. 13 figures, 2 tables.

9210 Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and in-group weighting schemes. Gabriel, T.A.; Bishop, B.L. (Oak Ridge National Lab., TN). *Nucl. Sci. Eng.;* **68**: No. 1, 94-99(Oct 1978).

The sensitivity of primary knock-on atom (PKA) spectra and displacement per atom (dpa) cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes is investigated. It is shown that the sensitivity of the PKA spectra and dpa cross sections for the (n,n' unresolved) and (n,2n) reactions in iron to different angular distributions and the same secondary neutron spectrum is reasonably large (approximately 15%). For grossly different secondary neutron spectra and the same angular distribution, the change in the dpa cross section is smaller than one would initially expect. It is also shown that, for aluminum, the sensitivity of dpa cross sections to different in-group weighting schemes is, for the most part, small. 3 figures, 6 tables.

RADIATION SOURCE CALIBRATION AND STANDARDIZATION

REFER ALSO TO CITATION(S) 9183

DOSIMETRY

REFER ALSO TO CITATION(S) 8922

SOLID STATE PHYSICS

REFER ALSO TO CITATION(S) 8595, 8629, 9033

9211 Inter—valence-band absorption in electron-hole droplets. Silver, R.N.; Aldrich, C.H. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Phys. Rev. Lett.;* **41**: No. 18, 1249-1253(30 Oct 1978).

The broad line shape for absorption due transitions between heavy-hole and spin-orbit bands in electron-hole droplets in Ge is explained. The calculation uses multiple-scattering concepts to remove the divergence of ordinary perturbation expansions in the dynamical Coulomb interaction. The absorption resembles the free-hole theory at low frequencies, is sensitive to both band anisotropy and screening approximations at intermediate frequencies, and is independent of screening at high frequencies.

9212 Zero-temperature renormalization method for quantum systems. I. Ising model in a transverse field in one dimension. Jullien, R.; Pfeuty, P.; Fields, J.N.; Doniach, S. (Laboratoire de Physique des Solides, Universite Paris-Sud, Centre d'Orsay, 91405 Orsay, France). *Phys. Rev., B;* **18**: No. 7, 3568-3578(1 Oct 1978).

A zero-temperature real-space renormalization-group method is presented and applied to the quantum Ising model with a transverse field in one dimension. The transition between the low-field and high-field regimes is studied. Magnetization components, spin correlation functions, and critical exponents are derived and checked against the exact results. It is shown that increasing the size of the blocks in the iterative procedure yields more accurate results, especially for the critical "magnetic" exponents near the transition.

9213 Spin—spin correlation functions for the two-dimensional Ising model. McCoy, B.M. (State Univ. of New York, Stony Brook); Tracy, C.A.; Wu, T.T. pp 83-97 of Statistical mechanics and statistical methods in theory and application. Landman, U. (ed.). New York; Plenum Publishing Corp. (1977).

A simplified derivation is given of an exact expression for the spin-spin correlation function of the two-dimensional Ising model suitable for studying large spin separation for T less than T/sub c/.

9214 Phase transitions in liquid crystals. Woo, C.W. (Northwestern Univ., Evanston, IL). pp 265-278 of Quantum fluids and

solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

The isotropic-nematic transition is discussed as an example of the kind of problems that one tackles in studying phase transitions in liquid crystals. The example chosen requires only elementary thermodynamical and statistical concepts. (GHT)

9215 Solid o-p-hydrogen: a comparison of theories of statistically disordered crystals. Biem, W.; Diehl, H.W.; Menn, K. (Univ., Giessen, Ger.). pp 315-322 of Quantum fluids and solids. Trickey, S.B.; Adams, E.D.; Dufty, J.W. (eds.). New York; Plenum Press (1977).

From Symposium on quantum fluids and solids; Sanibel Island, FL, USA (24 Jan 1977).

Mixtures of o-H_2 and p-H_2 or p-D_2 and o-D_2 respectively are model substances for theories and experiments about disordered crystals. They can be considered in parallel to dilute antiferromagnets. The spectra of librons as a function of the concentration of the "nonmagnetic" species (p-H_2; o-D_2) can be measured and calculated. Optical experiments with Raman scattering have already been performed. The k = o spectra measured in these experiments are the basis of a discussion of different approximations where the same quantity can be calculated. (GHT)

9216 Theory of light scattering in condensed matter. Bendow, B.; Birman, J.L.; Agranovich, V.M. (eds.). New York; Plenum Press (1976). 564p. (CONF-750582—). $39.50.

From Soviet-American symposium on theory of light scattering in solids; Moscow, USSR (26 May 1975).

Theoretical and experimental work on light scattering in solids, liquids, and liquid crystals is discussed, with emphasis on theoretical developments. Topics of special interest include phase transitions, electron—phonon interactions, electron--hole drops, scattering from superfluids, resonance scattering, nonlinear effects, polaritons, and spin-flip and electronic scattering. One paper from these proceedings has already been cited in ERA, and can be found by referring to the entry CONF-750582—in the Report Number Index. (RWR)

SUPERCONDUCTIVITY

REFER ALSO TO CITATION(S) 8636

GENERAL THEORY

9217 Lattice-dynamical calculations for Chevrel-phase superconductors. Bader, S.D.; Sinha, S.K. (Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Rev., B;* **18**: No. 7, 3082-3095(1 Oct 1978).

Born—von Karman (BvK) lattice-dynamical calculations were performed for the rhombohedral Chevrel-phase superconductors such as $PbMo_6S_8$. The dynamical matrix was obtained using Lennard-Jones (LJ) potentials, which describe interactions between Mo-Mo, Mo-S, S-S, and Pb-S pairs of atoms. The parameters for these potentials were adjusted using the comparison of the moments of the phonon spectrum F (ω) with their values obtained from heat-capacity data. Dispersion curves along the three-fold axis show a splitting of the three Pb-atom-dominated modes into a low-lying transverse doublet and a longitudinal singlet. These branches hybridize with the acoustic branches. F (ω) is calculated for binary and ternary Chevrel-phase sulfides and selenides by making appropriate mass changes. Moments and site-dependent projections of F (ω) are calculated and their associated Debye temperatures are tabulated. Torsional character is found for certain modes in agreement with previous identifications made using the molecular-crystal model. The heat capacity, entropy, inelastic neutron-scattering spectra, Moessbauer recoil-free fraction for ^{119}Sn, anharmonicity, the apparent T^2 resistivity below 40 K for sputtered films, and the form of the superconducting tunnelling spectrum α^2F are discussed. The applicability of the BvK approach using LJ potentials indicates that short-range interactions are important. Hence, the previously introduced molecular-crystal model is a reasonable, though not rigorous, simplification of the lattice dynamics of this important class of superconductors.

9218 Singularities of the energy "gap" of a superconductor. Makarov, V.I. (Physicotechnical Institute, Ukrainian Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 11, 579-582(5 Jun 1978).

The existence of singularities in the energy "gap" Δ (p,ω) in (p,ω) space is predicted. It is shown that in the general case the singularities in Δ (p,ω) are due to a change in the topology of the line of intersection of the Fermi surface with the phonon equal-energy surfaces.

9219 Superconductivity produced in multivalley semimetals by Coulomb interaction between the electrons. Babichenko, V.S. (Spectroscopy Institute, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 531-534(20 May 1978).

The feasibility and conditions of superconductivity in multivalley semimetals are considered with account taken of only the Coulomb interaction between the electrons. It is shown that, depending on the density, Cooper pairs with different orbital angular momenta can be produced.

ACOUSTIC, ELECTRIC, MAGNETIC, OPTICAL, AND THERMAL PHENOMENA

REFER ALSO TO CITATION(S) 8589, 8606

THEORETICAL PHYSICS

CLASSICAL AND QUANTUM MECHANICS

9220 Theory of hitches. Bayman, B.F. (Univ. of Minnesota, Minneapolis). *Am. J. Phys.;* **45**: No. 2, 185-190(Feb 1977).

If one end of a rope is tied to a pole and the other end is pulled, the hitch may slip or it may hold fast. A method of predicting which will happen is presented. The topology of the hitch determines an inequality involving the coefficients of friction characteristic of the rope and pole. If this inequality is satisfied, the different turns of the hitch press on each other, and on the pole, to produce a self-locking unit that can withstand an arbitrarily strong pull. 10 figures.

9221 Relativistic motion of composite systems with nonrelativistic internal dynamics. Morpurgo, G. (Univ., Genoa). pp 195-202 of Quarks and hadronic structure. Morpurgo, G. (ed.). New York; Plenum Press (1977).

From Workshop of the Ettore Majorana Center for Scientific Culture; Erice, Italy (Sep 1975).

A summary is given of two previous lectures in which the problem is presented of being able to treat by ordinary quantum mechanics a moving composite system the internal dynamics of which is specified in its rest system. The difficulties arising in the separation of the external kinematics from the internal dynamics are considered. The example of the harmonic oscillator is discussed. Applications to positronium photoproduction, reactions between nuclei in relativistic motion, a class of nuclear reactions in the relativistic quark model with the case of omega $\rightarrow \pi\gamma$ decay, and the electromagnetic decay of an oscillator are mentioned. 7 references. (JFP)

RELATIVITY AND GRAVITATION

REFER ALSO TO CITATION(S) 9049

OPTICS

9222 (CONF-780688—2) **Forward and backward stimulated Raman scattering in a multimode fiber.** Lin, C.H.; Nelson, M.A.; Marshall, B.B.; Theobald, J.K. (EG and G, Inc., Goleta, CA (USA)). 1978. Contract EY-76-C-08-1183. 17p. Dep. NTIS, PC A02/MF A01.

From Physics of fiber optics; Kingston, RI, USA (22 Jun 1978).

Several orders of forward and backward stimulated Raman scattering are generated by a pulsed dye laser in a multimode step-index fiber. Frequency spectra and temporal profiles at different power levels are recorded and discussed. 7 figures.

FUSION ENERGY

9223 Technology index for plasmaphysics research and fusion reactors. Volume 12, No. 8, 1978. Bibliography, author index, subject index, appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). 52p.

This bibliography contains 229 references on various aspects of plasma physics and thermonuclear reactors. (MOW)

9224 Technology index for plasmaphysics research and fusion reactors. Volume 12, No. 7, 1978. Bibliography, author index, subject index, appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1978). 54p.

This bibliography contains 226 references on various aspects of plasma physics and thermonuclear reactors. (MOW)

PLASMA RESEARCH

PLASMA CONFINEMENT AND HEATING

9225 (CONF-771155—P2, pp 401-423) **Fusion physics requirements.** Krall, N.A.; Stuart, G.W. (Science Applications, Inc., La Jolla, CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

The physics basics for operating a pure fusion or a hybrid fission—fusion reactor are described. (MOW)

9226 (CONF-771241—, pp 119-139) **Tokamak reactor startup studies utilizing RF and neutral beam heating.** Scharer, J.E. 1977.

From Plasma heating requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

In Proceedings of the plasma heating requirements workshop.

9227 (CONF-771241—, pp 141-162) **Heating and fueling requirements up to and beyond JET scale experiments.** Sheffield, J. (Oak Ridge National Lab., TN). 1977.

From Plasma heating requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

In Proceedings of the plasma heating requirements workshop.

9228 (LA-UR—78-1910) **Recent developments in linear theta-pinch and laser-heated solenoid research.** McKenna, K.F.; Bartsch, R.R.; Commisso, R.J. (Los Alamos Scientific Lab., NM (USA); Mathematical Sciences Northwest, Inc., Bellevue, WA (USA); Washington Univ., Seattle (USA)). 1978. Contract W-7405-ENG-36. 28p. (CONF-780811—9). Dep. NTIS, PC A03/MF A01.

From 7. conference on plasma physics and control; Innsbruck, Austria (23 Aug 1978).

At LASL, the experimental results from the high energy (T/sub e/ + T/sub i/ = 3.3 keV, n/sub e/ = 1.5 x 10^{16} cm^{-3}) 5-m Scylla IV-P theta pinch support the following: (1) single mode m = 1 "wobble" instability rotation frequencies of approximately 180 kHz are associated with axial wavelengths of 400 to 800 cm; (2) ion thermal conduction is an unimportant loss mechanism; (3) evidence of rarefaction-like waves is seen; (4) the normalized end-loss time is independent of the plasma beta and collisionality regime; (5) plasma flow from the ends remains collimated and convects magnetic fields; (6) LiD end plugs produce a three-fold increase in energy containment time over the open-ended configuration. Theoretical work at LASL has demonstrated the following: (1) an explanation of the m = 1 "wobble" instability has been formulated; (2) a correct description of end-loss must include the magnetic curvature term in the axial momentum equation. Mirrors increase the lifetime of a collisional plasma less than guiding center theory predicts; (3) magnetic field gradient drift can reduce the growth rate of the universal drift instability; (4) collisionless magnetoacoustic heating can be an effective heating mechanism in theta pinches. At MSNW-UW, CO_2 laser heating of low energy (T/sub e/ approximately equal to T/sub i/ approximately equal to 2 eV, n/sub e/ approximately equal to 2 x 10^{17} cm^{-3}) plasmas is accomplished over a one-meter column length. Maintenance of an on-axis density minimum is demonstrated.

9229 **Evidence for magnetic fluctuations as the heat-loss mechanism in the alcator tokamak.** Molvig, K.; Rice, J.E.; Tekula, M.S. (Plasma Fusion Center and Francis Bitter National Magnet Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Phys. Rev. Lett.;* **41**: No. 18, 1240-1244(30 Oct 1978).

It is argued that resonant magnetic fluctuations are the mechanism of anomalous electron heat loss in tokamaks. The experimental and theoretical support for this assertion are given.

9230 **Parametric lower-hybrid instability driven by modulated electron-beam injection.** Allen, G.R.; Owens, D.K.; Seiler, S.W.; Yamada, M.; Ikezi, H.; Porkolab, M. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). *Phys. Rev. Lett.;* **41**: No. 15, 1045-1048(9 Oct 1978).

A modulated electron beam is injected into a low-β plasma parallel to the confining field to investigate the energy-transfer rate from the electron beam to the plasma. Parametric excitation of electrostatic lower-hybrid waves and ion-cyclotron quasimodes is experimentally identified. The temperature of both ions and electrons is observed to increase significantly concomitant with the growth of the instability.

9231 **Heating of parametrically turbulent plasma.** Silin, V.P.; Tikhonchuk, V.T. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 9, 474-476(5 May 1978).

An expression for the rate of heating of a turbulent plasma is obtained under conditions of strong parametric coupling between the excited waves.

9232 **Electron thermal conductivity of microwave plasma in the Saturn stellarator.** Voitsenya, V.S.; Yu., A. Voloshko; Kravchin, B.V.; Solodovchenko, S.I.; Suprunenko, V.A.; Shtan', A.F. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 121-122(Mar 1978).

A high-frequency discharge in helium was employed to produce a current-free plasma in the Saturn stellarator. The measured thermal conductivity was compared to the predictions of neoclassical theory.(AIP)

9233 **Effect of nonlinear dissipation on plasma heating under high langmuir turbulence condition.** Kingsep, A.S. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Zh. Eksp. Teor. Fiz.;* **74**: No. 1, 99-111(Jan 1978). (In Russian).

The one- and three-dimensional problems of heating of plasma are considered by taking into account nonlinear effects. Accumulation of langmuir solitons due to dissipative slowing-down is investigated in the one-dimensional case. The time evolution of the spectrum under constant pumping conditions is obtained, and self-similar regime of electron heating is investigated. The influence of nonlinear conversion of langmuir oscillations into sound on heating of plasma during acoustic collapse is considered in the three-dimensional problem. The maximum value of the inertial interval corresponding to such conditions is estimated. The self-similar electron distribution for heating due to nonlinear conversion is obtained.

9234 **Transport calculations for a wall-confined liner-compressed plasma.** Waltz, R.E. (General Atomic Co., San Diego, Calif. (USA)). *Nucl. Fusion;* **18**: No. 7, 901-916(1978).

Theory and computations for a wall-confined slow-liner-compressed plasma are presented. The liner device considered has axial open-ended field lines. The numerical calculations include cross-field diffusion of magnetic field, heat, and impurities; compressional effects; heat loss to materially plugged ends; and radiation loss (including coronal impurity radiation). Both insulating and conducting liner boundary conditions are treated. The formation of a cold dense boundary layer is particularly severe in the former case. The heat transport is treated classically with some comparison to possible anomalous behaviour. While impurities are driven out of a straight high-β plasma by thermal forces, critical trace level amounts present at injection can be catastrophic. Some simple scaling laws for various loss mechanisms are given.

9235 **Kinetic properties of Alfven waves.** Hasegawa, A. (Bell Labs., Murray Hill, N.J. (USA)). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 151-174(Aug 1977).

Linear and nonlinear properties of kinetic Alfven waves are discussed. Applications of the kinetic Alfven wave to the supplementary heating of a Tokamak plasma are discussed. It is shown that with an external oscillating magnetic field of a few Gauss, nonlinear heating of ions can be expected at a required rate of 200 MW for a reactor plasma.

9236 **Flux of high-energy α-particles to tokamak walls due to the rippling of the longitudinal magnetic field.** Belikov, V.S.; Kolesnichenko, Ya.I.; Yavorskii, V.A. (AN Ukrainskoi SSR, Kiev. Inst. Yadernykh Issledovanii). *Fiz. Plazmy;* **3**: No. 3, 487-494(1977). (In Russian).

The effect of corrugation of a longitudinal magnetic field on confinement in plasma of high-energy particles being products of a thermonuclear reaction is discussed. It is shown that the field corrugation may lead to collisionless escapement of alpha particles whose production occurs at low longitudinal velocities. A general expression has been derived for the density of the particle flux on tokamak chamber walls. The expression was used to analyze the distribution of the alpha-particle flux on chamber walls and to estimate the magnitudes of the flux for tokamaks with a different degree of magnetic field corrugation. Most of the numerical estimations thus obtained relate to the newly designed T-20 tokamak.

9237 **Adiabatic plasma compression study in a tokamak by means of spectral methods.** Kaganskii, M.G.; Kalmykov, S.G.; Lebedev, S.V.; Shakhovets, K.G. (AN SSSR, Leningrad. Fiziko-Tekhnicheskii Inst.). *Fiz. Plazmy;* **3**: No. 3, 674-680(1977). (In Russian).

Results are presented on the study of line radiation of impurity ions in the visible and ultroviolet spectral regions. The study of the intensity spatial distribution has made it possible to determine the radial profile of electron temperature T/sub e/Cr) in the process of ohmic heating which precedes plasma compression. T/sub er/ in a compressed filament is determined by studying the time variation of spectral line intensities. The substantial asymmetry of T/sub er/ is caused by displacement of inner magnetic surfaces outwards as a

result of the increased β/sub j/. Plasma parameter calculations show that B/sub j/ increases from 0.6 to 2.0-2.5 in a course of compression. The maximum electron temperature in the compressed filament is approximately 400 eV, that is 1.7 times as high as that found for purely adiabatic heating. This fact points to better plasma thermal insulation. The energy lifetime increases from 150 μs for ohmic heating to 800 μs for the compressed filament. The time evolution of the radial profile of the OV line intensity confirms the efficiency of plasma compression with a magnetic field. Plasma density under compression shows a 3-fold increase in conformity with the adiabatic law.

9238 Device for generation, confinement and heating of the hot plasma in magnetic mirror reflex discharges. Popovici, C.; Mateescu, I.; Balaceanu, M.; Ionescu, G. (Institutul Central de Fizica, Bucharest (Romania)); Rotileanu, P.; Coatu, S.; Golovanov, N.; Stoian, M. (Institutul Politehnic, Bucharest (Romania)). *Stud. Cercet. Fiz.;* **29**: No. 6, 595-603(1977). (In Romanian).

A device for the study of a hot plasma in magnetic mirror field is presented. The device permits to achieve pulsed discharges of kilovolts and currents of amperes in a magnetic mirror field with B/sub max/ approximately 7 kgauss. Different parts which assure the automatisation, teleoperation and electronic control are described.

PLASMA DIAGNOSTICS

9239 (LA-UR—78-2342) **Neutron diagnostics for pulsed high-β plasmas.** Ekdahl, C.A.; Qunn, W.E. (Los Alamos Scientific Lab., NM (USA)). 1976. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

Time resolved measurements of the neutron flux from the Scylla IV-P experiment have been made with scintillator-photomultiplier combinations. These detectors are deployed in close proximity to the experiment which exposes them to a severe electromagnetic environment. This imposes exacting requirements on the shielding of the detectors which have been met by scrupulous attention to details of the shielding design. The neccessity for a direct calibration of these detectors is obviated by normalizing the time-resolved measurements to a measurement of the total neutron yield. This method requires a comparison of the time integrated detector output signal with the total neutron yield measured by a technique which relies on the activation of Rh foils by the neutron flux after it has been moderated in a polyethylene block. An accurate calibration for the Rh-foil yield detectors has been established by using the proton beam generated by a Van de Graf accelerator to produce 2.5 MeV neutrons with a negligible energy spread from the $T(p,n)He^3$ reaction.

9240 (LA-UR—78-2343) **Interferometric measurements of plasma density in high-β plasmas.** Quinn, W.E. (Los Alamos Scientific Lab., NM (USA)). 1977. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

The coupled-cavity laser interferometer technique is particularly applicable to the measurement of pulsed plasma densities. This technique is based on the fact that if a small fraction of a gas laser's output radiation is reflected into the laser with an external mirror, the intensity of the laser output is modulated. These amplitude or intensity modulations are produced by changes in the laser gain. A rotating corner mirror or an oscillating mirror can be used to produce a continuous feedback modulation of the interferometer which produces a continuous background fringe pattern. The presence of plasma in the outer cavity causes an additional change which results in a phase shift of the regular period of the background fringe pattern. The integral of the plasma density along the line of sight can be evaluated by comparison of the time history of the fringes obtained with and without plasma.

9241 (LA-UR—78-2344) **Faraday rotation measurements in high-β fusion experiments.** Quinn, W.E. (Los Alamos Scientific Lab., NM (USA)). 1977. Contract W-7405-ENG-36. 15p. Dep. NTIS, PC A02/MF A01.

The application of the rotation measurement to a linear magnetic-plasma system is described in which the integral n/sub e/(l)dl is determined by interferometric measurements and combined with the measured rotation integral B/sub i/(l)n/sub e/(l)dl to give the average value of the internal magnetic field B/sub i/(r) which exits over the plasma length l at the radius r. The measurements of B/sub i/(r) are combined with those of the external magnetic field B/sub e/ to determine the average plasma beta as a function of radius, $\beta = 1 - B^2$/sub i/(r)/B^2/sub e/. The Faraday rotation measurement uses a 1.5-mm diameter beam of visible radiation (6328 A) from a He—Ne gas laser as a plasma-magnetic field probe and a calcite Wollaston prism as the polarization analyzer with silicon diode detectors. The rotation is a small effect at optical wavelengths even for substantial densities and fields. The rotation is proportional to the square of the probing wavelength which suggests the use of infrared laser wavelengths. However, density gradients perpendicular to the beam direction cause beam deflections that also scale with lambda^2. The size and spatial sensitivity of detectors is also an important consideration in the selection of the probing wavelength.

9242 (SAND—78-1697C) **Vacuum ultraviolet spectroscopy of charged particle deposition in thin foils.** Burns, E.J.T.; Goldstein, S.A.; Johnson, D.J.; Kuswa, G.W.; Miller, P.A. (Sandia Labs., Albuquerque, NM (USA)). 1978. Contract EY-76-C-04-0789. 10p. (CONF-780851—1). Dep. NTIS, PC A02/MF A01.

From 9. symposium on the physics of ionized glass; Dubrovnik, Yugoslavia (28 Aug 1978).

The determination of energy deposition level by direct radiation temperature measurements is important in the inertial confinement fusion program. We describe several techniques and their application to recent experiments in the fusion program at Sandia. Radiation diagnostics in the soft x-ray vacuum ultra-violet are useful for determining temperatures from the slope of the continuum radiation in the temperature regime between 5 eV and a few hundred eV. The intensity ratio of resonant line transitions in successive ionization states can be used for measurements of electron temperature. Temperature measurements coupled with hydrodynamic models can be used to determine power deposition or specific power (power/mass) in a target.

9243 Resonance absorption of the emission from a laser-produced plasma. Belik, V.P.; Bobashev, S.V.; Shmaenok, L.A. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 108-109(Mar 1978).

The image profile of a laser-produced plasma used as a source of vacuum-UV radiation was determined.

9244 Double-frame hologram interferometer measurements on a fast theta pinch. Bryskin, V.Z.; Burtsev, V.A.; Litunovskii, V.N.; Smirnov, A.G.; Smirnov, V.G. *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 145-146(Mar 1978).

Details are given of a plasma diagnostic technique used to measure the spatial distribution and time evolution of the plasma density in the UTRO fast theta pinch. (AIP)

9245 Mass spectrometry of a spark plasma. Derzhiev, V.I.; Ramendik, G.I. (V. I. Vernadskii Institute of Geochemistry and Analytic Chemistry, Moscow). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 2, 186-189(Feb 1978).

Using an SM-602 double-focusing mass spectrometer, the ion composition of a spark plasma is studied as a function of the characteristics of the discharge circuit. (AIP)

9246 Technique for optical polarization measurements of a langmuir turbulence spectrum of a plasma. Zhuzhunashvili, A.I.; Oks, E.A. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Zh. Eksp. Teor. Fiz.;* **73**: No. 6, 2142-2156(Dec 1977). (In Russian).

Further analytical development is presented of the theory of effect on a hydrogen atom of stochastic high-frequency noises taking account of one-dimensional influence of quasi-static fields. This development deviates from the perturbation theory. The latter allows to considerably widen its application fields and to give a completely uncontradictory interpretation of experimental data. An optical method for measuring the amplitude-angular distribution of high frequency langmuir turbulence is described which is based on a polarization analysis of the Stark profiles of hydrogen spectral lines. The turbulence level as well as the direction diagram of langmuir noise produced in the plasma on annihilation of opposite magnetic fields are determined for the first time.

9247 Interferometric measurement of plasma density in the range 10^{19} - 10^{22} m^{-3}. Babicky, V.; Kolacek, K.; Ullschmied, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu); Malykh, N.I. (Fiziko-tekhnicheskii Institut, Sukhumi (USSR)). *Czech. J. Phys.;* **27**: No. 10, 1125-1128(1977).

A laser interferometer, operating at the wavelength lambda=0.337 mm suitable for plasma density measurements in the range 10^{19} to 10^{22} m^{-3} and simple construction of the HCN laser are described.

9248 Experimental determination of plasma pressure, energy time and electron temperature in the T-9 ring tokamak. Bortnikov, A.V.; Brevnov, N.N.; Gerasimov, S.N.; Zhukovskii, V.G.; Pergament, V.I.; Khimchenko, L.I. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 530-537(1977). (In Russian).

Experimental results are presented on the measurement of plasma pressure to magnetic field one ratio (βsub(I)), energy lifetime tausub(e) and plasma electron temperature Tsub(e) in the T-9 tokamak with a noncircular plasma filament section. Integral relations for an equilibrium toroidal filament of an arbitrary section were used. It has been found that: 1) βsub(I) changes in the range from 0.2 to 0.5; 2) in the range of the initial hydrogen pressures 10^{-4} (<=) P (<=) 1.8×10^{-4} Torr one can observe a growth of the given characteristics

with the discharge current and plasma density respectively; 3) the energy lifetime is close to a pseudoclassical value. The results were obtained at a toroidal magnetic field of 8 kOe.

9249 Spectroscopic structure and mass determination of plasma cluster accelerated by a coaxial gun. Kubes, P.; Hruska, J.; Bacilek, J. (Ceske Vysoke Uceni Technicke, Podebrady (Czechoslovakia). Fakulta Elektrotechnicka). *Czech. J. Phys.;* **27**: No. 9, 1022-1026(1977).

The structure of air cluster by spectral line intensities is determined using an unstationary collisional-radiative model. The ratio of filling gas and admixtures is stated. The dependence of cluster mass on the time delay of discharge after admitting of filling gas is calculated at known electron density and cluster volume.

9250 Multi-channel electron integrator for magnetic probe measurements with filtration of useful signals from background noises. Ponomarenko, N.P.; Tishchenko, I.E. *Prib. Tekh. Eksp.;* No. 3, 152-154(1977). (In Russian).

Consideration is given to a multichannel electronic integrator for magnetic measurements of a high-temperature plasma. The integrator permits filtering an useful signal off noises by the methods of time separation and algebraic addition of signals. The magnitude of a spurious signal at the output decreases by nearly one order of magnitude as compared with the level of an useful signal. The duration of integrated signals is between 100 μs and 20 ms. The dynamic range of the output voltages is +-8 V, the operating frequency band is 10 Hz - 20 kHz, the noise level is less than 5 mV. The electronic switches for time separation are based on field effect transistors. The open state of the gate is controllable within 500 μs - 20 ms.

9251 Apparatus for the electron energy distribution function measurement in the afterglow discharge. Tichy, M. (Karlova Universita, Prague (Czechoslovakia). Fakulta Matematicko-Fyzikalni). *Czech. J. Phys.;* **27**: No. 9, 1027-1033(1977).

A method for measuring the second derivative of the Langmuir probe characteristic in plasma with fast varying parameters is described. Discussion about its applicability and the results of measurements in the Ne afterglow are given.

9252 Ratio of intensities of fine structure components of hydrogen-like ions in a dense plasma. Vinogradov, A.V.; Skobelev, I.Yu.; Yukov, E.A. (AN SSSR, Moscow. Fizicheskii Inst.). *Fiz. Plazmy;* **3**: No. 3, 686-696(1977). (In Russian).

In connection with the problem of the dense plasma diagnostics the dependence of the intensity ratio of the components of the hydrogen-like ion fine structure on plasma density is studied. A formula has been obtained for the population ratio of levels 2p/sub 1/2) and 2p/sub 3/2/ in an optically-fine plasma. It is shown that in a wide range of densities this ratio is other than 1/2 due to a difference in the rates of the transitions 2s/sub 1/2/-2p/sub 1/2/ and 2s/sub 1/2/-2psup 3/2/ governed by collisions with electrons and ions. In this case the population ratio does not depend on density and is controlled by the level population mechanism with the principal quantum number n=2. It is demonstrated that the two excitation mechanisms (photorecombination and ground state excitation) are matched by the qualitatively different relations between component intensities. A dependence of the intensity ratio on the electron and ion temperatures is studied. Specific calculations are conducted for Mg12.

PLASMA KINETICS - GENERAL

9253 Fusion power. Lidsky, L.M. (Massachusetts Inst. of Tech., Cambridge). pp 5.137-5.149 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

The potentialities of controlled fusion are discussed. The physical conditions designated as milestones in the research program are enumerated. Experiments now in progress, engineering problems, and a possible scheme for relaxing both the physics and engineering constraints of an economical system are described. (MOW)

PLASMA KINETICS - EXPERIMENTAL

9254 Investigation of the electron energy distribution function in a neon afterglow plasma. Blagoev, A.B.; Popov, T.K. (Sofia Univ. (Bulgaria)). *Phys. Lett., A;* **66**: No. 3, 210-212(15 May 1978).

Probe measurements of the electron energy distribution function conducted in a neon afterglow plasma showed substantial deviations from a maxwellian distribution function in the high energy range. The differences result from Penning ionization and electron-metastable atom superelastic collisions.

9255 Plasma physics experiments at Physical Research Laboratory. Saxena, Y.C. (Physical Research Lab., Ahmedabad (India)). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 231-254(Aug 1977).

A brief account is given of the experiments in plasma physics being conducted at the Physical Research Laboratory, Ahmedabad (India). They are grouped under four categories viz., (i) instabilities in a weakly ionized plasma in crossed electric and magnetic field, (ii) nonlinear wave experiments in collisionless plasma, (iii) interaction of high density plasma with neutral gas cloud and (iv) electron trapping and non-adiabatic escape in magnetic mirror fields. These experiments have considerably helped the understanding of the phenomena such as electojet instability, single particle confinement and solar windcomet interactions.

9256 Ion temperature in the T-9 ring tokamak. Bortnikov, A.V.; Brevnov, N.N.; Zhukovskii, V.G.; Pergament, V.I. (Gosudarstvennyii Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 523-529(1977). (In Russian).

At the quasi-stationary discharge stage the ion temperature is in good agreement with the value found by the Artsymovich formula. The effect of anomalous heating of ions up to the high temperature (Tsub(i) > Tsub(e)) at the initial stage of plasma filament formation has been found. The anomalous heating depends heavily on the initial gas pressure, it being accompanied by intensive MHD oscillations, impingement of an accelerated electron beam onto a diaphragm, and rearrangement of filament structure.

9257 Relativistic electron beam relaxation in an inhomogeneous plasma. Golovanov, Yu.P.; Elagin, N.I.; Zakatov, L.P.; Kingsep, A.S.; Plakhov, A.G. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 619-625(1977). (In Russian).

Results are presented on the study of the relaxation of the electron beam with the energy of up to 250 keV and the current of 10 A in inhomogeneous plasma whose density increases along the beam. The beam energy losses are shown to depend on plasma density difference over the length of interaction. Beam energy losses were measured in the process of interaction for a fairly homogeneous plasma in the density range 10^{12} to 10^{15} cm^{-3}. Besides the dependence of the losses on the initial beam energy was studied.

9258 Wavelength of ionization waves and the electron energy losses in the d.c. discharge in rare gases. Krasa, J.; Perina, V.; Pekarek, L. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). *Czech. J. Phys.;* **27**: No. 11, 1232-1236(1977).

Changes in wavelength expressed by the wave potential (the product of wavelength and the longitudinal electric field intensity) are investigated in dependence on (similarity) parameters of the neon and argon d.c. discharge. The measured dependences show the influence of different states of the electron gas, which behaves hydrodynamically or kinetically (with spatial resonances) in dependence on the type of prevailing energy exchange by elastic, inelastic or Coulomb collisions.

9259 Optical study of the molecular ions in plasma. Pascu, M.L. (Institutul Central de Fizica, Bucharest (Romania)). *Stud. Cercet. Fiz.;* **29**: No. 4, 363-401(1977). (In Romanian).

Results are presented and discussed on the determination of the photoionization cross section of the molecular cesium in the spectral range of the molecular continuum overlapped on the principal series lines, the two photon absorption in Cs_2 molecules and the observation of molecular sattelites associated to the diffuse series of atomic Cs. The obtaining for the first time of a complete molecular spectrum by two photon absorption and of data describing the pressure effect of rare gases on alcaline metals atoms are reported. Mechanisms of formation of excited and strongly excited Cs molecules are clarified in Cs principal series as well. A display method is presented for computing angular characteristics of alcaline metals electron cloud. Perspectives of this research are discussed.

PLASMA KINETICS - THEORETICAL

9260 (LA—7429-MS) **Plasma transport and flow in the fluid picture.** Miller, G. (Los Alamos Scientific Lab., NM (USA)). Aug 1978. Contract W-7405-ENG-36. 21p. Dep. NTIS, PC A02/MF A01.

The fluid equations are applied to cylindrical pinches, and the role of resistivity, heat conductivity, and viscosity is examined. Analytical solutions for special cases are reviewed. One-dimensional partial differential equations suitable for numerical solution are derived that describe: (1) the radial evolution of a pinch and (2) theta-pinch end loss (for r = 0).

9261 (SAND—78-1287C) **Particle transport in an anisotropic medium.** Morel, J.E.; Allen, R.C.; Knief, R.A. (Sandia Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA)). 1978. Contract EY-76-C-04-0789. 6p. (CONF-781105—25). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

Little effort has been made to develop numerical transport methods which can treat differential scattering cross sections which depend explicitly upon vector Ω' and vector Ω, where vector Ω' and vector Ω denote the incident and emergent particle directions, respectively. Such cross sections are called asymmetric. As a first step in the development of a general technique a finite-element collocation method was developed for the solution of the one-dimensional transport equation in slab geometry with asymmetric scattering. One of the unexpected results is that the reflection coefficient can be less than unity for particles incident upon a non-absorptive semi-infinite slab. A set of calculations using both the new technique and a standard Monte Carlo technique were performed for a 100-mean-free-path-thick slab. The diffusion values and the discrete-ordinates values are in excellent agreement with the Monte Carlo values. It is concluded that the discrete-ordinates method is a valid one with potential application to the transport of neutral atoms in anisotropic plasmas. 1 table. (RWR)

9262 (UCID—17923) **Orbit-averaged kinetic equations for an axisymmetric mirror machine.** Matsuda, Y.; Rensink, M.E.;. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Sep 1978. Contract W-7405-ENG-48. 19p. Dep. NTIS, PC A02/MF A01.

The orbit-averaged kinetic equation suitable for studying collisional transport in an axisymmetric mirror machine is derived and reduced to a three-dimensional equation in phase space in the case of ν/sub c/ << ω/sub b/ << Ω where ν/sub c/ is the collision frequency, ω/sub b/ is the bounce frequency, and Ω is the gyrofrequency. We found that the gyrophase dependence of the distribution function, ignored in previous Fokker-Planck calculations, is responsible for the diffusion of guiding centers and should be retained when the Larmor radius is comparable to the plasma scale length. The complete Fokker-Planck equation for a square-well magnetic mirror is given as a special case to clarify the approximations and assumptions involved in the radial Fokker-Planck code of Futch. The quasilinear transport code of Matsuda and Berk is also discussed relative to the orbit-averaged Fokker-Planck equation.

9263 **Relativistic degenerate electron plasma.** Delsante, A.E.; Frankel, N.E. (Melbourne Univ., Parkville (Australia). School of Physics). *Phys. Lett., A;* **66**: No. 6, 481-483(26 Jun 1978).

The dielectric reponse function for a dense, ultra-degenerate, relativistic electron gas is presented. The dispersion relation, damping conditions and screened potential are obtained.

9264 **Thermodynamical properties of the relativistic quantum scalar plasma.** Diaz Alonso, J.; Hakim, R. (Observatoire de Paris, Section de Meudon, 92 (France)). *Phys. Lett., A;* **66**: No. 6, 476-480(26 Jun 1978).

The thermodynamical properties of the relativistic quantum scalar plasma (i.e. a system of spin one-half baryons interacting through a scalar field) are studied in the Hartree approximation.

9265 **Higher order multipoles and splines in plasma simulations.** Okuda, H.; Cheng, C.Z. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). *Comput. Phys. Commun.;* **14**: No. 3, . 169-176(1978).

The reduction of spatial grid effects in plasma simulations has been studied numerically using higher order multipole expansions and the spline method in one dimension. It is found that, while keeping the higher order moments such as quadrupole and octopole moments substantially reduces the grid effects, quadratic and cubic splines in general have better stability properties for numerical plasma simulations when the Debye length is much smaller than the grid size. In particular the spline method may be useful in three-dimensional simulations for plasma confinement where the grid size in the axial direction is much greater than the Debye length.

9266 **Self similar solution of plasma equations.** Lonngren, K.E. (Wisconsin Univ., Madison (USA). Mathematics Research Center). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 125-139(Aug 1977).

The technique of self-similar solution of partial differential equations is summarized. The technique is applied to several problems in plasma physics such as linear and nonlinear 1-D diffusion equations, diffusion in more than one dimension, Korteweg-de Vries equation, ion acoustic wave equations for the fluid model and Vlasov model.

9267 **Implications of Navier-Stokes turbulence theory for plasma turbulence.** Montgomery, D. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 87-110(Aug 1977).

A brief discussion of Navier-Stokes turbulence theory is given with particular reference to the two dimensional case. The MHD turbulence is introduced with possible applications of techniques developed in Navier-Stokes theory. Turbulence in Vlasov plasma is also discussed from the point of view of the "direct interaction approximation" (DIA).

9268 **Initial stage of discharge development in tokamak.** Abramov, V.A.; Vikhrev, V.V.; Pogutse, O.P. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 512-522(1977). (In Russian).

The paper considers a one-dimensional nonstationary model of the initial stage of discharge development in a toroidal system. The system of nonlinear differential equations in partial derivatives including an equation for electron density, mean energy of an electric field and Ohm's law is solved numerically. Energy losses in ionization and radiation are taken into account. An expression of the Bohm's diffusion coefficient type is used. It is shown that the breakdown model under consideration permits reasonable estimates of ionization time and its dependence on basic plasma parameters. The most indefinite parameters, namely diffusion and heat conduction coefficients, produce little effect on this model. The electric field critical value V_1 has been established. At $V < V_1$ the discharge develops in a quasi-homogeneous fashion; at $V > V_1$ a strong skin effect is observed.

9269 **Plasma motion equations in a weakly rippled magnetic field.** Shapiro, D.A. (AN SSSR, Novosibirsk. Inst. Yadernoi Fiziki). *Fiz. Plazmy;* **3**: No. 3, 545-550(1977). (In Russian).

Longitudinal motion is treated of a dense plasma in a weakly corrugated magnetic field with the corrugation scale smaller than the free-path length for charged particles. Plasma-magnetic field friction force has been found by calculation for the case when the effective frequency of ion-ion collision is lower than the oscillation frequency of trapped particles in a mirror device and in the reverse extreme case. A closed system of equations has been obtained for electron and ion densities and temperatures.

9270 **Physical models for the description of an electrodynamically accelerated plasma sheath.** Zambreanu, V. (Institutul Central de Fizica, Bucharest (Romania)). *Stud. Cercet. Fiz.;* **29**: No. 9, 977-995(1977). (In Romanian).

An analysis of the models proposed for the description of the plasma sheath dynamics in a coaxial system (of the same type as that operating at the Bucharest Institute of Physics) is presented. A particular attention is paid to the physical structure of the accelerated plasma. It has been shown that a self-consistent model could be derived from a phenomenological description of the sheath structure. The physical models presented so far in the literature have been classified into three groups: the hydrodynamic models, the plasma sheet models and the shock wave models. Each of these models is briefly described. The simplifying assumptions used in the construction of these models have been pointed out. The final conclusion has been that, under these assumptions, none of these models taken separately could completely and correctly describe the dynamical state of the plasma sheath.

9271 **Self-similar solutions of nonlinear evolution equations of physical significance.** Nakach, R. (CEN, Grenoble, France). pp 456-474 of Plasma physics: nonlinear theory and experiments. Wilhelmsson, H. (ed.). New York; Plenum Press (1977).

From Nobel symposium on nonlinear effects in plasmas; Lerum, Sweden (11 Jun 1976).

Solutions are presented for the Korteweg-De Vries and modified Korteweg-De Vries equations, the nonlinear Schroedinger equation, the Sine-Gordon equation, and the nonlinear string equation. (MOW)

PLASMA PRODUCTION

9272 **Experimental determination of the relaxation times for establishing a quasi-steady-state population in a laser created plasma in helium.** Baravian, G.; Godart, J.; Sultan, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique des Plasmas). *Physica, B, C;* **94**: No. 2, 275-280(May 1978).

An experimental determination of the relaxation times for establishing a quasi-steady-state population in a helium discharge plasma perturbed by the irradiation of an intense laser light leads to times of about 3.5 X 10^{-7} s for the triplet 4^3D and 3^3D levels and 2 X 10^{-7} s for the singlet 3^1P level for plasma parameters of nsub(e) approximately 4 X 10^{15} cm^{-3} and Tsub(e) approximately 2 eV. The diagnostic used is mainly the time resolved spectroscopy of the light emitted by the perturbed region of the initial plasma.

PLASMA INSTABILITIES

REFER ALSO TO CITATION(S) 9228, 9320, 9323

9273 (UWFDM—248) **MHD equilibrium and stability of NUWMAK.** Mai, L.P.; Emmert, G.A.; Conn, R.W. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Jun 1978. Contract EY-76-S-02-2272. 9p. (CONF-780508—72). Dep. NTIS, PC A02/MF A01.

From 3. meeting on the technology of controlled thermonuclear fusion; Santa Fe, NM, USA (9 May 1978).

NUWMAK is a high power density, noncircular conceptual tokamak fusion reactor design. The device is found to be magnetohydrodynamically stable except for vertical instability due to bad curvature of the external B/sub z/ field. The MHD equilibrium properties of NUWMAK are obtained by solving the Grad-Shafranov equation numerically. Only 8 equilibrium field coils are required to provide plasma equilibrium and proper shape control. The average plasma power density is about 10.1 MW/m^3 and the neutron wall loading is 4.3 MW/m^2. The plasma current is 7.2 MA, the major radius is 5.13 m, the plasma width is 1.13 m and the plasma height to width ratio is 1.64. The on-axis magnetic field is 6.05 Tesla and toroidal β is 6% while the safety factor q at edge is found to be 2.63.

9274 Numerical simulation of trapped-electron instabilities in toroidal geometry. Cheng, C.Z.; Okuda, H. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). *Phys. Rev. Lett.;* **41**: No. 16, 1116-1119(16 Oct 1978).

Dissipative trapped-particle instabilities are studied by means of three-dimensional particle simulations in toroidal geometry. In the linear stage, growth rates of the unstable modes and the radial and poloidal ballooning mode structures observed in the simulation agree reasonably well with linear theory. In the nonlinear stage, the ballooning effect diminishes because of the generation of strong plasma turbulence resulting in the broad frequency spectrum and convective cells consistent with experimental observations.

9275 Stabilization of tearing instability in stationary flow of a plasma. Vulanov, S.V.; Sasorov, P.V. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 521-523(20 May 1978).

It is shown that the spreading of a plasma over a current sheath (CS) may turn out to be a strong stabilizing factor if the growth rate of the tearing instability (TI), calculated for the static case, is small in comparison with the relative rate of expansion of the CS.

9276 Non-ideal M.H.D. equations with application to the stability of a rotating plasma column. Janssen, P. (Stichting voor Fundamenteel Onderzoek der Materie, Eindhoven, The Netherlands). *Physica, B, C;* **94**: No. 2, 251-258(May 1978).

In this paper the author considers a low-β plasma confined in a magnetic field in which, in contrast to the F.L.R. ordering, for the core region the electrical force is more important than the pressure gradient force (M.H.D. ordering). Non-ideal M.H.D. equations are obtained from the moment equations. Considerations concerning the outer region result, for example, in boundary conditions for the oscillations in the core region. The stability of a cylindrical plasma column is investigated for some special cases and the agreement with experiment is discussed.

9277 Parametric excitation of high-frequency electromagnetic waves in a plasma. Tsikarishvili, E.G. (Abastumani Astrophysical Observatory, Academy of Sciences of the Georgian SSR). *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 132-133(Mar 1978).

Parametric instabilities in a relativistic homogeneous electron plasma are studied theoretically account taken of the oscillation of the electron mass.(AIP)

9278 Drift dissipative instability in a two temperature plasma. Goswami, B.N.; Satya, V.S.; Kulkarni, V.H. (Physical Research Lab., Ahmedabad (India)). *Pramana;* **9**: No. 2, 171-178(Aug 1977).

The presence of a small amount of relatively cold electrons in an otherwise hot plasma reduces the ion sound speed in the medium and hence reduces the growth rate of the drift dissipative ion acoustic mode in an inhomogeneous weakly ionized plasma. This is expected to improve the confinement time in certain magnetic confinement schemes. The propagation of a small but finite amplitude mode in the presence of ion viscosity is also investigated by using reductive perturbation method. It is shown that, when the damping due to ion viscosity is stronger than the growth due to collisions, there exists a stationary shock solution.

9279 Non-linear stability of a weakly ionized plasma. Malik, S.K. (Punjab Univ., Chandigarh (India). Dept. of Mathematics). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 175-185(Aug 1977).

The asymptotic non-linear theory of the interchange modes in a weakly ionized plasma in a strong magnetic field is presented in the small gap approximation. The basic equations are given with initial and boundary conditions governing the problem. Eigenfunctions are derived and used to develop the asymptotic non-linear theory. A precise form of the Landau's description of slightly unstable plasma motions is obtained. The time and space average flux is calculated in the radial direction for ksub(o) = ksub(c) = π.

9280 Effect of coherent and turbulent spectrum of waves on trapped particle modes. Sundaram, A.K. (Physical Research Lab., Ahmedabad (India)). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 187-192(Aug 1977).

Three types of instabilities arising in particles trapped in helical magnetic fields are described viz., (i) the collisionless trapped particle mode, (ii) dissipative trapped ion mode, and (iii) the dissipative trapped electron mode. Two stabilization methods for these trapped particle modes are considered viz., the parametric heating scheme and the background turbulence scheme. The two methods are discussed in some detail. The advantages and disadvantages of the two methods are briefly discussed.

9281 Modulation instability in a inhomogeneous pumping field. Davydova, T.A.; Shamrai, K.P. (AN Ukrainskoi SSR, Kiev. Inst. Yadernykh Issledovanii). *Fiz. Plazmy;* **3**: No. 3, 591-599(1977). (In Russian).

A study has been made of the parametric instability of an inhomogeneous pumping field with respect to excitation of high- and low-frequency disturbances. It is shown that an absolute instability of the modulation type is likely to develop near the inhomogeneous field intensity peak. The instability threshold and also the increments and dimensions of the instable disturbance localization region have been calculated. For weak pumping fields the increment is proportional to the first degree and for strong fields - to the square of the field intensity. At a higher pumping intensity the instable disturbance localization region becomes smaller. A comparison is provided with the results of numerical experiments.

9282 Electron instability of plasma configuration with splitted magnetic surfaces. Gordeev, A.V. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 556-561(1977). (In Russian).

A study has been made of the stability of a current sheath with splitted magnetic surfaces with respect to electron disturbances of the helicon type. It is shown that the two-dimensional configuration of a magnetic field with a spatial period may by instable relative to large-scale disturbances resulting in a greater spatial period.

9283 Effect of compressibility on the plasma helical instability. Gutkin, T.I.; Tsypin, V.S.; Boleslavskaya, G.I. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskii Inst.). *Fiz. Plazmy;* **3**: No. 3, 501-503(1977). (In Russian).

It is demonstrated that allowance made for compressibility leads to a higher increment of the helical instability of plasma with a fixed boundary (HIFB) and changes significantly the picture of the rotation effect. Consideration is given to the case of an infinitly long plasma cylinder with a distributed current producing an azimuthal magnetic field. The plasma filament is in a strong longitudinal magnetic field, rotates with the angular frequency ω and is surrounded by an ideally conductive wall. By using the equation of ideal magnetic hydrodynamics for the description of plasma behaviour it has been found that in the case of rotation even for HIFB stabilization new oscillation branches appear whose increments are of the same order of magnitude as that for HIFB.

9284 Selftuning feedback system for stabilization of the plasma flute instability. Gvozdkov, Yu.V.; Cherkashin, M.Yu.; Chuyanov, V.A. (AN SSSR, Moscow. Inst. Problem Upravleniya; Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 566-571(1977). (In Russian).

The application of the feedback with automatic control amplification factor to the problem of flute instability stabilization is discussed. The experiments were carried out on a simple magnetic mirror trap LIN-5 with injection of fast hydrogen atoms, provided with a 12 electrode stabilization system. The experiments have revealed that the existing representation of the nature of flute instability and its interaction with a feedback system are reasonably accurate so that they can underlie the extremely complex control systems. Moreover, a conclusion has been made as to the absence of density limitations associated with the inner mode instabilities.

9285 Impurity instabilities in the tokamak. Mikhailovskii, A.B.; Shukhman, I.G. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 495-500(1977). (In Russian).

Impurity instabilities in a tokamak are under study. Two kinds of such impurities are considered whose presence is caused by trapped ions. These instabilities are shown to be weakly sensitive to the shear and therefore at certain plasma parameters they may be of interest from the viewpoint of impurity dynamics problems in tokamaks.

9286 Current-convective instability of a plasma with impurities. Petrov, V.G. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). *Fiz. Plazmy;* **3**: No. 3, 562-565(1977). (In Russian).

A study has been made of the current-convective plasma instability governed by variation in the impurity relative density. A

nonlinear stage has been considered. Consideration is given to the model problem of plasma stability with two kinds of ions (i, z). It is assumed that plasma cylinder is in external electric and magnetic fields directed along the cylinder axis. For the outer cylinder surfaces the problem may be regarded as two-dimensional one. The plasma temperature is constant (T/sub z/=T/sub i/=T/sub e/ =const), and the densities of basic ions n/sub i/ and impurity ions n/ sub z/ changes along the radius. A turbulent diffusion coefficient has been found, and it is shown that the rate of impurity penetration from walls into plasma volume in the development of the instability may increase substantially.

9287 Helical instability of a non-ideally conductive plasma. Pogutse, O.P.; Yurchenko, E.I. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Fiz. Plazmy;* **3**: No. 3, 504-511(1977). (In Russian).

The paper discusses continuous transition from plasma filament helical instability with a current in a longitudinal magnetic field to a tearing instability. It is shown that in the real experimental situation even at a high temperature on the filament periphery a helical instability develops on account of the electron inertia, the instability increment being only several times smaller than the increment on a free boundary. A dispersion equation has been obtained permitting the calculation of the helical instability increment at plasma parameters of practical interest. At the greater dimensions of the current channel the helical instability increment is shown to drop whilst the stable safety factor range becomes wider.

9288 Parametric instability of low-frequency surface waves. Zaboronkova, T.M.; Kondrat'ev, I.G. (Gor'kovskii Gosudarstvennyi Univ. (USSR). Nauchno-Issledovatel'skii Radiofizicheskii Inst.). *Fiz. Plazmy;* **3**: No. 3, 551-555(1977). (In Russian).

A study has been made of the induced scattering linear stage of an intensive HF wave into a low-frequency (ion-acoustic) surface wave. It is shown that for a HF wave with the electric field vector in the incidence plane the slight plasma boundary diffusion is responsible for a smaller threshold amplitude of the incident field. This drop is caused by a sharp increase in the normal-to-boundary component of the HF field in the region of the passage through plasma resonance. The study has been exemplified by the simplest case of a homogeneous HF field oriented perpendicularly to plasma boundary.

PLASMA WAVE PHENOMENA

REFER ALSO TO CITATION(S) 9235, 9288

9289 Resistive lower-hybrid instability in current-carrying plasmas. Chu, L.W.M.; Lee, K.F. (Chinese Univ. of Hong Kong, Shatin). *Phys. Lett., A;* **66**: No. 5, 377-378(12 Jun 1978).

Obliquely propagating lower hybrid waves are found to be unstable in a collisional, fully-ionized plasma carrying a field-aligned current.

9290 Wavenumber spectra of turbulent ionization waves in Ne discharge. Krasa, J.; Perina, V. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). *Phys. Lett., A;* **66**: No. 5, 379-380(12 Jun 1978).

The one-dimensional wavenumber spectra of turbulent ionization waves were measured from the light fluctuations of the positive column. The experimentally obtained spectra were decreasing from an optimum wave number k_0 to the higher wave numbers as k/sup -1.6/.

9291 One-dimensional collapse of plasma waves. Litvak, A.G.; Sergeev, A.M. (Institute of Applied Physics, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **27**: No. 10, 517-520(20 May 1978).

It is shown, with upper-hybrid quasipotential plasma waves as an example, that one-dimensional collapse of oscillations takes place in systems described by a Schroedinger equation with nonlocal nonlinearity.

9292 Oscillations in a finite length plasma cylinder in an external magnetic field. Elmiger, H.P.; Vaucher, B.G.; Schneider, H. (Fribourg Univ. (Switzerland). Inst. de Physique); Vaclavik, J. (Ecole Polytechnique Federale, Lausanne (Switzerland)). *Helv. Phys. Acta;* **50**: No. 6, 871-892(31 Mar 1978). (In German).

The oscillations in a magnetized plasma cylinder of finite length excited by a concentric coil have been investigated. These investigations were carried out with frequencies between 1 MHz (below first magneto-acoustic resonance) and 100 MHz (above lower hybrid resonance). The plasma parameters were n/sub e/ = 2.4×10^{14} cm^{-3}, T/sub e/ = 1.3 eV and B_0 = 9 kG. Axial and radial profiles of the B/sub z/-component were measured and compared with a theory derived for a cylinder of finite length. All maxima and minima found are well described by these calculations. The absolute value fails in some cases. This discrepancy is explained partly by the simplifications in our calculation and partly by impurities in the discharge generated plasma.

9293 Barrier penetration in an inhomogeneous magnetized plasma. Galushko, N.P.; Dakhov, V.M.; Erokhin, N.S.; Moiseev, S.S.; Muratov, V.I.; Filippenko, V.E. *Sov. Tech. Phys. Lett. (Engl. Transl.);* **4**: No. 3, 104-105(Mar 1978).

The regeneration of a propagating of wave beyond the wave barrier was observed.(AIP)

9294 Correlation of the fluctuations and surface-wave spectrum in an inhomogeneous plasma cylinder. Gradov, O.M.; Kirii, A.Y. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 306-309(Mar 1978).

The correlation between the electrical field and the surface-wave spectrum of a highly inhomogeneous plasma cylinder is studied. In this cylinder the temperature is inhomogeneous and isotropic, and the scale dimension of the density inhomogeneity is comparable to the effective radius of the plasma cylinder. The binary correlation function of the electric field is shown to be governed by the radial electron temperature at the wing of the density profile of the cylinder. The spectral correlation function reaches a maximum at frequencies equal to the resonant frequencies for surface waves. The real part of the surface-wave frequency is very sensitive to the nature of the radial decay of the density, and the damping of these waves is due to the density gradient in the low-density part of the plasma.

9295 Parametric excitation of nonlinear waves at the upper hybrid resonance. Demchenko, V.V.; Kravtsov, P.I. (A. M. Gor'kii Khar'kov State University). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **23**: No. 3, 378-379(Mar 1978).

The effect of a highly inhomogeneous static magnetic field on the growth of nonlinear plasma waves is studied theoretically. (AIP)

9296 Kinetic theory of nonlinear interaction of waves in a semibounded plasma. Sitenko, A.G.; Pavlenko, V.N. (AN Ukrainskoi SSR, Kiev. Inst. Teoreticheskoi Fiziki; AN Ukrainskoi SSR, Kiev. Inst. Fiziki). *Zh. Eksp. Teor. Fiz.;* **74**: No. 1, 128-140(Jan 1978). (In Russian).

A kinetic theory of nonlinear interaction between waves in a semi-bounded plasma is developed for a specular reflection model. A nonlinear field equation is obtained and employed to investigate resonant interaction between surface waves which leads to decay and explosive instability.

9297 Simulation of the growth of axially symmetric discharges between plane parallel electrodes. Davies, A.J.; Evans, C.J.; Woodison, P.M. (University Coll. of Swansea (UK)). *Comput. Phys. Commun.;* **14**: No. 3, . 287-297(1978).

The program SPARK 2 computes the axial and radial development of an axially symmetric electrical discharge between plane parallel electrodes. The processes incorporated are primary ionization, attachment, detachment, secondary cathode emission due to the incidence of photons and positive ions, space-charge distortion of the applied field and the properties of the external electrical circuit. SPARK2 is a two-dimensional extension of SPARK71. It is complementary to and not a replacement for this program. The charge densities of the electrons and negative ions, and the net charge density, are governed by time-dependent hyperbolic differential equations in two space dimensions. The equations for the electrons and negative ions are integrated along the two characteristic directions in (x,r,t) space, while the equation for the net density is solved by an implicit finite difference scheme.

9298 Excitation of coherent electromagnetic radiation by a relativistic electron beam in a plasma with a free surface, surrounded by a metal liner. Ivanov, S.T. *Zh. Tekh. Fiz.;* **47**: No. 9, 1801-1803(Sep 1977). (In Russian).

Interaction of a relativistic electron beam with a plasma surrounded by a metal sheath is theoretically investigated. It is shown that in the strongly magnetized plasma an excitation of coherent electromagnetic radiation is possible. As it occurs the excitation is of a resonance character and is possible in a narrow range of plasma parameters. Efficiency of transformation of kinetic beam energy into electromagnetic radiation energy increases in such a system as compared to a system without a sheath.

9299 Radiation pattern of open ended waveguide in air core surrounded by annular plasma column. Sharma, D.R. (Himachal Pradesh Univ., Simla (India). Dept. of Physics); Verma, J.S. (Birla Inst. of Tech. and Science, Pilani (India). Dept. of Physics). *Indian J. Radio Space Phys.;* **6**: No. 3, 174-177(Sep 1977).

Radiation pattern of open ended waveguide excited in circular symmetric mode (TM_{01}) in an air core having central conductor and surrounded by an annular plasma column is studied. The field distribution at the open end of the waveguide is considered to be equivalent to the vector sum of magnetic current rings of various

radii, ranging from the outer radius of the inner conductor to the inner radius of the outer conductor of the waveguide at the open end. The radiation field is obtained as a vector sum of field components due to individual rings of current. Such a configuration gives rise to multiple narrow radiation beams away from the critical angle.

9300 Observations of plasma wave states. Bengston, R.D.; Sanchez, A. (Texas Univ., Austin (USA). Dept. of Physics). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 223-230(Aug 1977).

Excitation of finite levels of high frequency waves has relevance in the study of nonlinear phenomena and plasma heating. The development of a high frequency plasma wave structure originating during the formation of the plasma and persisting well into the afterglow is discussed. The helium satellite technique (optical probe) used in these observations is described.

9301 Three-dimensional nonlinear Schroedinger equation for plasma waves. Buti, B. (Physical Research Lab., Ahmedabad (India)). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 141-150(Aug 1977).

Using the multiple space time method of Krylov-Bogoliubov-Mitropolsky, the three-dimensional nonlinear Schroedinger equations have been self consistently derived and analysed for nonlinear ion acoustic and Langmuir waves in turbulent plasmas. The stability and the collapse of the systems are discussed.

9302 Numerical analysis of high power laser propagation in magnetized plasmas. Druce, R.L.; Kristiansen, M.; Hagler, M.O. (Texas Tech Univ., Lubbock (USA). Plasma Lab.). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 255-263(Aug 1977).

The laser-plasma interaction is studied mathematically by partial differential equations describing plasma momentum, energy transfer and the wave equations for the laser beam. A computer code is developed to solve the equations. The code is used to study two problems of interest : a preliminary parameter study of bleaching wave behaviour and a comparison with experimental results obtained in previous laboratory investigations. Comparison of prediction by calculation with experiment is found to be good.

9303 Nonlinear processes in laser light absorption. Forslund, D.W.; Kindel, J.M.; Lee, K.; Lindman, E.L. *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 193-208(Aug 1977).

The momentum deposition of an incident light wave on an expanding plasma is such as to cause a severe distortion of the local electron density profile and the flow field. This alternation or steepening of the plasma profile has profound effects on parametric instabilities and the relative importance of instability processes. The origins of this steepened profile, its effect on laser light absorption and its stability are discussed.

9304 Space periodicity and time oscillations in a discharge plasma. Pekarek, L.; Krejci, V. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). *Cesk. Cas. Fys.;* **27**: No. 4, 354-362(Aug 1977). (In Czech).

The tendency to spontaneous oscillations and to the formation of spatial periodicity (strata) is a typical feature of nonisothermal discharge plasma. The microphysical processes causing this effect are shortly described starting from a simplified model, in which the ionization process plays the most important part. Further development of the theory of ionization waves is specified with a more detailed account of nonisothermal plasma, including the inherent non-equilibrium of the electron gas and its non-local behaviour. It is shown that the theory of ionization instabilities has direct bearing on processes which are decisive for the exploitation of the discharge plasma in lasers.

9305 Some aspects of wave nonlinear interactions in a plasma. Vil'gel'msson, Kh.; Nakash, R. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Elektromagnetisk Faeltteori). *Fiz. Plazmy;* **3**: No. 3, 600-606(1977). (In Russian).

Some types of formal relations between various nonlinear effects of wave interactions are discussed and cases, when the use of the general nonlinear theory is useful for the establishment of the nature of wave solution, are studied. An equation is considered for coherent three-wave interactions describing space/time variations of complex amplitudes with allowance made for the effects of absorption and detuning. In the case of a strong absorption and detuning of one of the waves the equation system reduces to a system of two nonlinearly bound equations similar to the equations of nonlinear radiation transfer. This is exemplified by the Volterra problem of two conflicting populations. The system of basic nonlinear evolution equations was studied analytically, allowance being made for dissipation. It is shown that the initial two-equation system can be transformed to a single equation for one dependent variable.

9306 Ion acoustic plasma turbulence in a nonmonochromatic pumping wave field. Aliev, Yu.M.; Gradov, O.M.; Izmailov, G.N. *Fiz. Plazmy;* **3**: No. 3, 586-590(1977). (In Russian).

It has been found that in plasma located in a modulated SHF electric field, when the modulation frequency approximates the acoustic frequency or its doubled magnitude, the parametric instability is developed. This results in the appearance of a turbulent quasi-stationary state characterized by a transient period and a definite noise level. The instability saturation mechanism under study consisting energy transfer from an increasing mode into a damped harmonic of plasma oscillations results in the oscillator type of the excited wave amplitude growth onto a stationary level. The time dependence of the increasing oscillation amplitude and the effect of dissipative processes in plasma on the establishment of the stationary turbulent state are investigated.

9307 Correlation measurements on regular and irregular ionization waves in neon. Krasa, J.; Pekarek, L. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav); Rothhardt, L.; Ose, E. (Academy of Sciences of GDR, Jena. Central Institute of Electron Physics). *Czech. J. Phys.;* **27**: No. 10, 1121-1124(1977).

The evolution from regular to fully irregular motion of the s' variety of an ionization wave in neon is studied by space correlation measurements. The correlation functions clearly indicate the onset of strongly nonlinear interaction (by a change in the decay constant of the correlation function) in the region of coherent wave motion, the transition to irregular wave motion (short distance correlation only) and the stochastic character of fully developed irregular wave motion (correlation only over a few wavelengths and a few periods).

FUSION POWER PLANT TECHNOLOGY

REFER ALSO TO CITATION(S) 8132

9308 (CONF-771155—P1) **Proceedings of the second fusion—fission energy systems review meeting. Volume I.** Bogart, S.L. (ed.). (Department of Energy, Washington, DC (USA). Office of Fusion Energy). Jul 1978. 306p. Dep. NTIS, PC A14/MF A01.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

Each paper has been separately processed for the Energy Data Base.

9309 (CONF-771155—P1, pp 83-97) **Fusion—fission systematics.** Lidsky, L.M. (Massachusetts Inst. of Tech., Cambridge). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

The nuclear physics that underlies a classification scheme for proposed fusion-fission hybrids is outlined. (MOW)

9310 (CONF-771155—P1, pp 99-122) **Mirror hybrid reactor studies.** Bender, D.J. (Lawrence Livermore Lab., CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

A summary is given of the reference design study. The power conversion loop is also described. (MOW)

9311 (CONF-771155—P1, pp 145-182) **Present status of laser driven fusion—fission energy systems.** Maniscalco, J.A.; Hansen, L.F. (Lawrence Livermore Lab., CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

The potential of laser fusion driven hybrids to produce fissile fuel and/or electricity has been investigated in the laser program at the Lawrence Livermore Laboratory (LLL) for several years. Our earlier studies used neutronic methods of analysis to estimate hybrid performance. The results were encouraging, but it was apparent that a more accurate assessment of the hybrid's potential would require studies which treat the engineering, environmental, and economic issues as well as the neutronic aspects. More recently, we have collaborated with Bechtel and Westinghouse Corporations in two engineering design studies of laser fusion driven hybrid power plants. With Bechtel, we have been engaged in a joint effort to design a laser fusion driven hybrid which emphasizes fissile fuel production while the primary objective of our joint effort with Westinghouse has been to design a hybrid which emphasizes power production. The hybrid designs which have resulted from these two studies are briefly described and analyzed by considering their most important operational parameters.

9312 (CONF-771155—P1, pp 251-275) **New initiatives in tokamak hybrid reactor design.** Varljen, T.C. (Westinghouse Electric Corp., Pittsburgh). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

The objectives and design philosophy of a near-term Demonstration Tokamak Hybrid Reactor (DTHR) are described. The fusion driver concept, blankets, materials, and exhaust studies are included. (MOW)

9313 (CONF-771155—P2) **Proceedings of the second fusion—fission energy systems review meeting. Volume II.** Bogart, S.L. (ed.). (Department of Energy, Washington, DC (USA). Office of Fusion Energy). Jul 1978. 277p. Dep. NTIS, PC A13/MF A01.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

Separate abstracts were prepared for 14 of the included papers. (MOW)

9314 (CONF-771155—P2, pp 297-326) **Fusion—fision hybrid breeders: economic and performance issues, role of advanced converters, interdependence between fission and fusion programs.** Augenstein, B. Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

This paper considers nuclear breeding systems (i.e., production of fissile fuel from fertile materials). The range of breeding technologies considered is deliberately wide. We include systems which breed by using internal neutron sources—a reactor-breeder, exemplified by the liquid metal fast breeder reactor (LMFBR)—and systems which breed by using external neutron sources—exemplified in this paper primarily by hybrid fusion-fission breeders.

9315 (CONF-771155—P2, pp 327-348) **Economic regimes.** Deonigi, D.E. (Battelle Pacific Northwest Labs., Richland, WA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

Cost-benefit studies were made for LWR's, LMFBR, CTR, hybrid reactors, and coal. Fuel cost figures are given. Forecasts were made for the year 2000. (MOW)

9316 (CONF-771155—P2, pp 441-457) **Tokamak technology requirements: the ORNL fusion power demonstration study.** Steiner, D.; Shannon, T.E. (Oak Ridge National Lab., TN). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

The major emphasis of this study is in the application of current and near-term technology as the most logical path to near-term demonstration of tokamak fusion power. The discussion will focus on the areas having the greatest overall impact on reactor feasibility: (1) overall size and power output, (2) remote maintenance considerations, (3) electrical power supplies, (4) blanket design, and (5) economics.

9317 (CONF-771155—P2, pp 459-483) **Technology requirements for fusion—fision reactors based on magnetic mirror confinement.** Moir, R.W. (Lawrence Livermore Lab., CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

Technology requirements for mirror hybrid reactors are discussed. The required 120-keV neutral beams can use positive ions. The magnetic fields are 8 T or under and can use NbTi superconductors. The value of Q (where Q is the ratio of fusion power to injection power) should be in the range of 1 to 2 for economic reasons relating to the cost of recirculating power. The wall loading of 14-MeV neutrons should be in the range of 1 to 2 MW/m^2 for economic reasons. Five-times higher wall loading will likely be needed if fusion reactors are to be economical. The magnetic mirror experiments 2XIIB, TMX, and MFTF are described.

9318 (CONF-771155—P2, pp 503-512) **Alternate fusion concepts for hybrid systems.** Rose, P.H. (Mathematical Sciences Northwest, Inc., Bellevue, WA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

A summary of the results from the DOE workshop evaluating the alternate magnetic fusion concepts is given. (MOW)

9319 (CONF-771155—P2, pp 513-521) **Tokamak demonstration hybrid reactor.** Teofilo, V.L. (Battelle Pacific Northwest Labs., Richland, WA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

Brief descriptions are given of the fusion driver, blanket design, and capital costs. (MOW)

9320 (CONF-780811—32) **Very small aspect ratio tokamaks.** Peng, Y.K.M.; Dory, R.A. (Oak Ridge National Lab., TN (USA)). 1978. Contract W-7405-ENG-26. 43p. Dep. NTIS, PC A03/MF A01.

From 7. conference on plasma physics and control; Innsbruck, Austria (23 Aug 1978).

Magnetohydrodynamic (MHD) stability analyses are carried out for tokamak equilibria with A = 2.0 and 1.5 q(boundary)/q(axis) approximately equal to 2, and β/sub p/ approximately equal to A/2. When a conducting wall is at a distance 0.2a from the plasma with A = 1.5, the critical anti β/sub t/(= 8πp/B/sub to/) values are found to be 0.47, 0.37, and 0.33 for toroidal mode numbers N = 1, 2, and 3, respectively. A linear extrapolation in 1/N → 0 results in a anti beta/sub tc/ of 0.28, which is consistent with the results based on analyses of large N ballooning modes on each flux surface. For the case of A = 2.0, anti β/sub tc/ values on plasma parameters are quantified together with suggested approaches to produce the plasma via adiabatic compression.

9321 (LA-UR—78-2322) **Engineering design of a toroidal reversed-field pinch reactor (RFPR).** Hagenson, R.L; Krakowski, R.A. (Los Alamos Scientific Lab., NM (USA)). 1978. Contract W-7405-ENG-36. 7p. (CONF-780953—1). Dep. NTIS, PC A02/MF A01.

From 10. symposium on fusion technology; Padova, Italy (4 Sep 1978).

A conceptual engineering design of a Reversed-Field Pinch Reactor (RFPR) is presented. A design point is described that is based upon a long-pulse operation of a superconducting, air-core system. Major engineering systems are described on the basis of this cost-optimized design. Ease of maintenance is a primary design objective.

9322 (NRL-MR—3826) **Experimental and theoretical liner fusion studies.** Book, D.L.; Burton, R.L.; Cooper, A.L. (Naval Research Lab., Washington, DC (USA)). Aug 1978. Contract EX-76-A-34-1006. 19p. (CONF-780811—31; IAEA-CN—37-E-5). Dep. NTIS, PC A02/MF A01.

From 7. conference on plasma physics and control; Innsbruck, Austria (23 Aug 1978).

The two U.S. facilities currently engaged in imploding liner experimental programs have adopted contrasting approaches. In both, the liner implosion heats plasma by adiabatic compression. The NRL Linus concept uses a rotationally stabilized thick liquid metal liner hydrodynamically imploded at subsonic speeds, compressing a magnetically confined plasma, then rebounding without loss of integrity. The LASL Fast Liner experiment employs thin solid metal liners, electromagnetically imploded at supersonic speeds, compressng a wall-confined ($\beta > 1$) magnetically insulated plasma, with subsequent destruction of the liner. Results of recent experiments, theoretical liner dynamics and plasma physics calculations, and considerations relevant to reactor designs are presented.

9323 (PPPL—1472) **Low-aspect-ratio limit of the toroidal reactor: the spheromak.** Bussac, M.N.; Furth, H.P.; Okabayashi, M.; Rosenbluth, M.N.; Todd, A.M.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1978. Contract EY-76-C-02-3073. 26p. (CONF-780811—26; IAEA-CN—37-X-1). Dep. NTIS, PC A03/MF A01.

From 7. conference on plasma physics and control; Innsbruck, Austria (23 Aug 1978).

The ideal and resistive MHD stability properties of a class of toroidal plasma configurations ("spheromaks") having internal toroidal and poloidal fields, and external poloidal fields are considered. The reactor advantage of the spheromak is twofold: (1) The maximum field strength at the external coils is about half the field at the plasma center, rather than twice, as in a tokamak. (2) A roughly spherical blanket can be used, rather than a blanket that links the plasma topologically. Taylor's criterion, which insures stability against both ideal and resistive modes, has been applied to force-free spheromaks of unity aspect ratio. In the presence of a loosely fitting external conducting shell, oblate spheromaks are stable against all modes except short-wave surface kinks (which are an artifact of the idealized current density profile). The Mercier criterion gives a β-limit below 1%; however, at aspect ratio approximately > 1 the β-limit for representative spheromak models rises into the range 2 to 4%. The Mercier analysis has been confirmed by Balloon Code studies. The ideal MHD Pest Code is being applied to spheromaks of various aspect ratios and current density profiles. Ideal MHD stabil-

ity can be obtained in the presence of a loosely fitting conducting shell.

9324 (UCRL—81554) **Tandem mirror physics and TMX.** Fowler, T.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Aug 1978. Contract W-7405-ENG-48. 20p. (CONF-780946—2). Dep. NTIS, PC A02/MF A01.

From Driven magnetic fusion reactors; Erice, Italy (18 Sep 1978).

The Tandem Mirror Experiment (TMX) is being built at Livermore to test the principles of the new tandem mirror reactor concept. In this concept the fusion plasma is confined in a long solenoid terminated at each end by mirror machines of the magnetic-well type. High density plasmas are maintained in each of the mirror end cells by neutral injection at high energies (up to 1 MeV in a high Q reactor). The usual positive ambipolar potential that automatically develops in each mirror cell serves as an electrostatic barrier that confines ions in the solenoid for many collision times, and the very stable plasmas in these end cells "anchor" each flux tube, thereby assuring MHD stability of the system up to betas of order unity in the solenoid. The TMX will test these main features of the tandem mirror idea and will also investigate optimum means of suppressing loss cone instabilities in the end cells based on methods demonstrated in the 2XIIB experiment. The end cells will be similar in size and injected power to 2XIIB, but some injectors will operate at 40 kV. Expected parameters are n tau approximately 10^{11} cm^{-3} sec at ion energies of 20 keV in the end plugs and n tau approximately 1 to 3 x 10^{11} cm^{-3} sec in the solenoid at ion temperatures up to 2 keV if auxiliary beam heating is applied to the solenoid. The solenoid field will be variable up to about 4 kG and the length is 5 meters. The facility is nearing completion (18 months construction time) and experiments are expected to begin early in 1979.

9325 (UCRL—81555) **U. S. Mirror Program.** Fowler, T.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Aug 1978. Contract W-7405-ENG-48. 22p. (CONF-780946—1). Dep. NTIS, PC A02/MF A01.

From Driven magnetic fusion reactors; Erice, Italy (18 Sep 1978).

The mirror approach is now the principal alternate to the tokamak in the U.S. magnetic fusion energy program. The program is now focused on two new concepts that can obtain high values of Q, defined as the ratio of fusion power output to the neutral beam power injected to sustain the reaction. These are the tandem mirror and field reversed mirror concepts. Theoretically both concepts should be able to attain Q = 5 or more, as compared with Q approximately 1 in previous mirror designs. Success with either or both of these approaches would point the way toward fusion power plants with many attractive features. The linear geometry of mirror systems offers a distinct alternative to the toroidal tokamak. As a direct consequence of this difference in geometry, it is generally possible to build mirror systems in smaller units of modular construction that can probably be made to operate in steady-state. During the next 5 years the main mirror facilities in the U.S. will be the 2XIIB (renamed Beta II); a tandem mirror experiment caled TMX; and the Mirror Fusion Test Facility (MFTF) scheduled to be completed in 1981 at a cost of $94 million. As a background for discussing this program and mirror reactor concepts in later lectures, the current status of mirror physics will be reviewed by comparing theory and experimental data in four critical areas. These are adiabatic confinement of individual ions, electron heat losses out of the ends of the machine, the achievement of beta values of order unity; and stabilization of "loss cone" modes.

9326 (UCRL—81579) **Field-reversed mirror reactor.** Carlson, G.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Sep 1978. Contract W-7405-ENG-48. 23p. (CONF-780946—3). Dep. NTIS, PC A02/MF A01.

From Driven magnetic fusion reactors; Erice, Italy (18 Sep 1978).

The reactor design is a multicell arrangement wherein a series of field-reversed plasma layers are arranged along the axis of a long superconducting solenoid which provides the background magnetic field. Normal copper mirror coils and Ioffe bars placed at the first wall radius provide shallow axial and radial magnetic wells for each plasma layer. Each of 11 plasma layers requires the injection of 3.6 MW of 200 keV deuterium and tritium and produces 20 MW of fusion power. The reactor has a net electric output of 74 MWe and an estimated direct capital cost of $1200/kWe.

9327 (UCRL—81586) **Physics of field reversed mirrors.** Post, R.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Sep 1978. Contract W-7405-ENG-48. 44p. (CONF-780946—5). Dep. NTIS, PC A03/MF A01.

From Driven magnetic fusion reactors; Erice, Italy (18 Sep 1978).

Since the earliest days of fusion research it has been hoped that diamagnetic currents flowing in a plasma could be used to help confine the plasma. Recently this hope has been strengthened both by theoretical advances and by experimental results made possible by technological developments. On the theoretical front analytical treatments and computer simulation studies have demonstrated equilibrium solutions existing both in the fluid limit and in the large-orbit limit. Progress has also been made in determining the conditions required for the stability of field-reversed entities. It appears that configurations of the general form of fat doughnuts, possibly elongated to napkin-ring form, represent stable states. Building on previous experimental work, several investigators have been able to create field-reversed states. One method, based on the ASTRON idea of Christofilos, traps an intense relativistic electron beams (REB) to create a field-reversing current ring. Other approaches use either the reversed field theta pinch technique or REB pulses to create field-reversing diamagnetic currents in a long cylindrical plasma. In the former method, millisecond-long field-reversing electron rings have been achieved; in the latter method field-reversed plasma states lasting 30 to 50 microseconds have been achieved. Another approach under investigation is the Field Reversed Mirror (FRM) created by the tangential injection of high current neutral beams. Plasma states that approach field reversal have been achieved by this technique.

9328 **Migmacell - a low-gain 'driven' fusion power amplifier as an interim energy source.** Maglich, B.C. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **151**: No. 1, . 1-27(1 May 1978).

A fusion program less ambitious in its objectives and technology than the official programs, but such that it could be reduced to practice before the large 'ignited' plasma fusion power reactors with 'infinite gain' become a reality, is described. 'Migmacell' is designed as a 'driven' power amplifier, energized by fusion, with a gain of 1.5-3. By recirculating a significant fraction of the output power, migmacell is a small (1 m in diam), self-sustained power source of 100 kW/sub e/ to 5 MW/sub e/. By using direct nuclear collisions in 'self-colliding orbits', it operates at the equivalent kinetic 'temperatures' at least 100 times higher than thermonuclear devices. From the point of view of plasma physics, migmacell is a simple 'colliding-beam' mirror with large gyoradius, highly non-adiabatic orbits and highly non-isotropic density, peaked at the center. Focusing action results in low classical end-losses compared to plasma mirrors. The fusion power density is high, 0.1 kW/cm^3. Diamagnetic effects are confined mostly to the central region, where they cause a min-B well. High energy migma fusion renders it possible to utilize the environmentally acceptable 'advanced fuels' such as D, ^{3}He or boron, rather than D-T, thus lending itself to a 'clean fusion' power source which is neutron-free or neutron-deficient. Larger plants are envisioned as a plurality of standardized migma-cells, thus solving many problems in power transmission and distribution. Economic projections indicate a competitive power source. State-of-the-art technology is assumed throughout.

9329 **Fusion Reactor Design-II. Report on the second IAEA technical committee meeting and workshop, Madison, Wisconsin, USA, 10-21 October 1977.** Conn, R.W.; Kulcinski, G.L. (Wisconsin Univ., Madison (USA)); Frank, T.G. (Department of Energy and LASL, USA); Hancox, R. (UKAEA, Abingdon. Culham Lab.); Schmitter, K.H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (Germany, F.R.)); Stacey, W.M. Jr. (Georgia Inst. of Tech., Atlanta (USA)). *Nucl. Fusion;* **18**: No. 7, 985-1016(1978).

A summary is given of the experimental, demonstration and commercial fusion reactor concepts presented at the Second IAEA Technical Committee Meeting and Workshop on Fusion Reactor Design. The potential role of fusion power as an inexhaustible energy source is discussed, the advances and trends in fusion reactor design assessed, and the major conclusions and recommendations of five workshop groups given. At present, designs for tokamaks are most heavily represented, with the emphasis on near-term reactor studies. Conceptual commercial reactors are becoming compact, high-power-density units. Reactor concepts are also presented for Q-enhanced mirror machines, alternate magnetic fusion concepts, and laser- and electron-beam-driven inertial confinement reactors. The fusion-fission hybrid concepts open up several approaches to fusion power, and special-topic papers cover technology problems and fusion commercialization.

9330 **Initial numerical studies of the behaviour of Z-pinch plasma under liner implosion conditions.** Lindemuth, I.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.); Jarboe, T.R. (Los Alamos Scientific Lab., N.Mex. (USA)). *Nucl. Fusion;* **18**: No. 7, 929-938(1978).

The principle of achieving thermonuclear temperatures by compression of a z-pinch plasma with a solid liner is demonstrated by one- and two-dimensional numerical calculations of the behaviour of the plasma under liner implosion conditions. The magnetohydrodynamic plasma model used includes radiation, thermal conduction, and resistive diffusion. The magnetohydrodynamic partial differential equations are solved by a computer code employ-

ing implicit finite-difference methods. The liner is represented by a moving, rigid wall, and the entire Eulerian finite-difference mesh linearly contracts as the liner moves inward. The effects of end losses and unstable boundary layer formation are demonstrated. The plasma is shown to behave significantly non-adiabatically, although some plasma is nearly adiabatically compressed. For an assumed initial plasma/magnetic-field configuration and an assumed liner velocity of $1 cm\mu s^{-1}$, plasma of $10^{18} cm^{-3}$ and 600eV is heated to peak temperatures of nearly 20keV when the plasma volume is reduced by a factor of 900.

9331 Present state of investigation on controlled thermonuclear fusion. Chuyanov, V.A. *At. Energ. (USSR);* **43**: No. 5, 351-359(Nov 1977). (In Russian).

The hall-mark of current developments in controlled thermonuclear fusion is a successful approach to the well-known breakeven criteria. With atomic beam injection and high-frequency heating tokamak devices have made a tremendous success. With the current pace research and development programs the breakeven condition in tokamak devices is likely to be reached by 1985. The incentive to ease the economic burden of expensive magnetic systems in the present-day tokamaks and stellarators has resulted in the development of open plasma devices with magnetic mirrors. With the development of power lasers and relativistic electron beams a substantial progress has been made in the direction of thermonuclear microexplosions. Given very low efficiency of current lasers (<1%) thermonuclear devices with relativistic electron beams are most promising in meeting the breakeven. It is concluded that thorough investigations should be conducted in the direction of developing hybrid D-T thermonuclear reactors with uranium blankets. They have by an order of magnitude lower breakeven criteria and are capable of ensuring fuel supply for LWR fission reactors.

9332 Tokamak-10 first experimental results. Strelkov, V.S. *Vestn. Akad. Nauk SSSR;* No. 8, 39-40(1977). (In Russian).

The program of experiments at the Tokamak-10 (T-10) included the study of the Joule plasma heating, the determination of the relative importance of various loss mechanisms, studying the dependence of the time of energy containment in plasma on plasma parameters, investigating inpurities in a hydrogen plasma. Experiments were carried out at magnetic fields of 35 kOe and at currents in the plasma of 400 kA. Deuterium was used as the operating gas. Ion temperature measurement results according to the charge exchange atom spectrum are shown. The energy life time in T-10 was 0.04 s. The density averaged over the plasma filament section was $7-8 \times 10^{13} cm^{-3}$. The measurements of the absolute value of the soft X-ray emission intensity and of the plasma resistance, and a comparison of the measured values with calculated ones for hydrogen plasma without impurities have shown that the relative amount of impurities in T-10 is not large. The results of the initial experiments at T-10 confirm the correctness of the physical concepts on plasma heating and mechanism of energy losses, which were taken into account when selecting T-10 parameters.

BLANKET ENGINEERING

REFER ALSO TO CITATION(S) 7543

9333 (BNL—24907) **Two-dimensional heating analysis of fusion blankets for synfuel production.** Lazareth, O.W.; Tsang, J.S.K.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 6p. (CONF-780953—3). Dep. NTIS, PC A02/MF A01.

From 10. symposium on fusion technology; Padova, Italy (4 Sep 1978).

Fusion reactors could be used to generate electric power and produce synthetic fuels with relatively high efficiencies (about 60%). A two temperature zone blanket coupled to a high temperature electrolysis system would be used. An important parameter in this system is the ratio of the fusion neutron kerma energy absorbed by the hot interior (the higher temperature zone) to the total energy/fusion. This parameter is calculated as approximately .5 for both a one and two-dimensional model of the blanket module, and is a reasonable value for efficient energy production.

9334 (CONF-771155—P1, pp 277-296) **New initiatives in laser driven fusion—fision.** Maniscalco, J.A.; Hansen, L.F. (Lawrence Livermore Lab., CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

It was demonstrated that fusion-fission hybrids exhibit the best energy multiplication and fissile fuel production performance when the region closest to the fusion source is a uranium fast-fission blanket, and the potential of this type of blanket was explored with two different after-blanket options: A ^{233}U-producing thorium after-blanket, and a power-producing thermal lattice. The neutronic analysis of the thorium after-blanket option leads one to conclude that one can design a laser fusion driven hybrid which multiplies the fusion neutron energy by a factor of five and produces enough ^{233}U to fuel more than ten thermal burner reactors of equivalent thermal power. With capital costs in the neighborhood of three times an LWR, the cost of electricity in the combined hybrid-burner reactor scenario can be expected to increase less than 30% over present prices.

9335 (CONF-771155—P2, pp 377-400) **Nuclear design of fast hybrid blankets.** Lee, J.D. (Lawrence Livermore Lab., CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

The objective of this presentation is to: (1) Present the physical motivation for fusion-fission hybrids, (2) outline design considerations for hybrid blankets, and (3) discuss the nuclear performance potential of hybrid blankets.

9336 Direct energy conversion in fusion reactors. Moir, R.W. (Univ. of California, CA). pp 5.150-5.154 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Two classes of direct energy converters are being studied: electrostatic and magnetic. The electrostatic converter is essentially a linear accelerator run backwards. That is, fast ions from the fusion plasma enter the "exit" of the accelerator and are decelerated and finally collected. By this process, the kinetic energy of the ions is directly converted to electric potential energy. The magnetic direct energy converters are analogous to the internal-combustion engine. As the hot plasma expands against a moving magnetic-field front in a manner similar to that in which hot gases expand against a moving piston, part of the energy of the internal plasma is inductively converted to an electric current in the magnet (pickup) coil.

9337 Tritium breeding requirements in fusion reactor blankets. Steiner, D. (Oak Ridge National Lab., TN). pp 5.155-5.157 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

Calculations were made for a 1000 MW(e) plant. The characteristics and breeding performance of several proposed blankets are given. (MOW)

MAGNET COILS AND FIELDS

REFER ALSO TO CITATION(S) 8679, 8681, 8682, 8683, 9236

9338 (BNL—24904) **Preliminary deals magnet system design study for HFITR.** Hsieh, S.Y.; Powell, J.R.; Bezler, P. (Brookhaven National Lab., Upton, NY (USA); Grumman Aerospace Corp., Bethpage, NY (USA)). 1978. Contract EY-76-C-02-0016. 8p. (CONF-780953—7). Dep. NTIS, PC A02/MF A01.

From 10. symposium on fusion technology; Padova, Italy (4 Sep 1978).

The application of the Demountable Externally Anchored Low Stress (DEALS) magnet concept to a High Field Ignition Test Reactor (HFITR) is considered in this paper. The TF magnet design, its demountability and the reactor accessibility is described. Results of finite element stress analyses of the support structure and the coil are given. Estimated heat inputs and refrigeration requirements are calculated. The feasibility of utilizing a movable pressure contact is examined.

9339 (BNL—24905) **Safety issues for superconducting fusion magnets.** Hsieh, S.Y.; Reich, M.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 13p. (CONF-780508—75). Dep. NTIS, PC A02/MF A01.

From 3. meeting on the technology of controlled thermonuclear fusion; Santa Fe, NM, USA (9 May 1978).

Safety issues for future superconducting fusion magnet systems are examined. It is found that safety and failure experience with existing superconducting magnets is not very applicable to predictions as to the safety and reliability of fusion magnets. Such predictions will have to depend on analysis and judgement for many years to come, rather than on accumulated experience. A number of generic potential structural, thermal-hydraulic, and electrical safety problems are identified and analyzed. Prevention of quenches and non-uniform temperature distributions, if quenches should occur, is of great importance, since such events can trigger processes which lead to magnet damage or failure. Engineered safety features will be necessary for fusion magnets. Two of these, an energy dispersion system and external coil containment, appear capable of reducing the probability of coil disruption to very low levels. However, they do not prevent loss of function accidents which are of economic concern. Elaborate detector, temperature equalization, and energy re-

moval systems will be required to minimize the chances of loss of function accidents.

9340 (CONF-771155—P2, pp 523-538) **Reactor studies of tokamak hybrids.** Tenney, F.H.; Mills, R.G. (Princeton Univ., NJ). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

To evaluate the commercial feasibility of a tokamak hybrid reactor we considered the economics of a "nuclear park" consisting of both the hybrid reactor and the satellite fission burners supported by the fissile fuel (plutonium) bred in the hybrid. The only product of the park was assumed to be electricity. The figure of merit for a particular hybrid design was the cost of producing electricity at the one and only bus bar of the nuclear park.

9341 (ORNL/TM—6040) **Analytic, high β, flux conserving equilibria for cylindrical tokamaks.** Sigmar, D.J.; Vahala, G. (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 37p. Dep. NTIS, PC A03/MF A01.

Using Grad's theory of generalized differential equations, the temporal evolution from low to high β due to "adiabatic" and nonadiabatic (i.e., neutral beam injection) heating of a cylindrical tokamak plasma with circular cross section and peaked current profiles is calculated analytically. The influence of shaping the initial safety factor profile and the beam deposition profile and the effect of minor radius compression on the equilibrium is analyzed.

9342 (UCRL—80926) **Fabrication of the MFTF magnet windings.** Deis, D.W.; Henning, C.D.; Hinkle, R.E.; Kopytoff, V.; MacDonald, J.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Sep 1978. Contract W-7405-ENG-48. 6p. (CONF-780952—12). Dep. NTIS, MF A01.

From Applied superconductivity conference; Pittsburgh, PA, USA (25 Sep 1978).

Portions of document are illegible.

The Lawrence Livermore Laboratory (LLL) is currently in the construction stage of the Mirror Fusion Test Facility (MFTF). MFTF will be the next large mirror fusion experiment and employs a large set of superconducting Yin-Yang coils. These coils contain 54,430 kg of stabilized NbTi conductor and will generate a peak field of 7.68 T with a stored energy of 409 MJ. This paper presents details of the design of these coils and the status of the fabrication.

9343 **Fast reconstruction of the magnetic field structure of a current sheet.** Kirii, N.P.; Markov, V.S.; Frank, A.G.; Khodzhaev, A.Z. (AN SSSR, Moscow. Fizicheskii Inst.). *Fiz. Plazmy;* 3: No. 3, 538-544(1977). (In Russian).

The magnetic field structure of a current sheet and its time evolution are investigated experimentally. It is shown that the sheet, whose elongation ratio is about 10, exists stably for 2 μs. An effect has been observed of the rapid rearrangement of the current-sheet magnetic field structure, which manifests itself under certain initial conditions as a sharp local growth of a normal-to-magnetic field component. The phenomena may by interpreted as initiation of the macroscopic rupture of the current sheet.

9344 **Superconducting magnets as applied to fusion reactors.** File, J. (Princeton Univ., NJ). pp 5.158-5.172 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).

A review of the historical development of superconductivity research is given. The application of superconductivity and cryogenics to fusion devices is briefly described. (MOW)

POWER SUPPLIES, ENERGY STORAGE

REFER ALSO TO CITATION(S) 8330

9345 (LA—7447-MS) **Analysis of a dc commutator machine for exchange of energy with a superconducting coil.** Vogel, H.F. (Los Alamos Scientific Lab., NM (USA)). Aug 1978. Contract W-7405-ENG-36. 18p. Dep. NTIS, PC A02/MF A01.

A 500-kW dc commutator machine, C, is analyzed for use in an LC circuit with a ringing period of approximately 4 s with a superconducting coil, L. Electrical measurements and the important design equations and characteristics are listed. Attention is paid to the calculation of the commutating voltage, which is an important design feature because it sets a limit to the current allowable in the LC circuit, amounting to 6 times rated machine current. The equations for the energy loss components of the generator are given and fitted to experimental coast-down data. With a fitting accuracy of 1.2%, the loss coefficients for the bearing loss, brush loss, windage loss, and tooth eddy current loss in the remanent stator field are thus determined.

HEATING AND FUELING SYSTEMS

REFER ALSO TO CITATION(S) 8636

9346 (CONF-771155—P1, pp 183-249) **Preliminary evaluation of a U-233 fusion—fission power system without reprocessing.** Schultz, K.R.; Brogli, R.H.; Hopkins, G.R.; Shirley, G.W.; Burnett, S.C. (General Atomic Co., San Diego, CA). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

A preliminary evaluation was made of the technical feasility of using a fusion reactor to breed ^{233}U from thorium in high temperature gas cooled fission reactor fuel and of then using this fuel in a fission reactor without reprocessing. Estimates of the neutronic performance of thorium fusion reactor blankets were made. The fuel cycle characteristics of high temperature gas-cooled reactors operating on nonreprocessed fusion-bred ^{233}U fuel were also estimated. The system performance of symbiotic fusion-fission power systems without reprocessing was then determined.

9347 (CONF-771155—P2, pp 539-551) **Advantages and limitations of high-gain, mixed-cycle hybrid reactors.** Woodruff, G.L. (Univ. of Washington, Seattle). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

A High-Gain, Mixed-Cycle (HGMC) hybrid reactor has two distinguishing characteristics. High-Gain implies that the "fission-plate" located either very near or immediately adjacent to the blanket first wall contains a significant percentage (approximately 8%) of fissile isotopes. The term, Mixed-Cycle, connotes the use of U-238 and Pu-239 in the fission-plate for neutron and energy multiplication together with a thorium-containing region in which U-233 is produced. Both U-233 and power (in some form) are produced for sale in a HGMC reactor and the performance characteristic of such a plant may be attractive, especially for relatively near-term applications.

9348 (CONF-771155—P2, pp 553-578) **Simple economics parametric analysis of fissile fuel production by fusion—fision reactors.** Krakowski, R.A.; Tai, A.S. Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

A simplified but general analytic model is formulated and evaluated to relate all major elements of fissile-fuel production by fusion-fission (hybrid) reactors on basis of simple economic constraints. The hybrid reactor performance is examined in terms of its fissile-fuel conversion ratio, blanket multiplication, and intrinsic efficiency. A stationary, equilibrium fissile-fuel/energy market is assumed, and the economically constrained performance is evaluated parametrically as a function of burner-converter conversion ratio, plant capital costs, and ratio of fissile-fuel to energy costs. The model and results presented herein can be applied to other means of fissile-fuel production (e.g., electronuclear breeders).

9349 (GA-A—15085) **Measured and predicted beam attenuation in neutral beam drift ducts for tokamaks.** Kamperschroer, J.H.; Colleraine, A.P.; Stewart, L.D. (General Atomic Co., San Diego, CA (USA)). Jul 1978. Contract EY-76-C-03-0167-038. 9p. (CONF-780953—4). Dep. NTIS, PC A02/MF A01.

From 10. symposium on fusion technology; Padova, Italy (4 Sep 1978).

Experimental evidence obtained with the Princeton Large Torus, PLT, neutral beam injectors at both the Oak Ridge National Laboratory and at Princeton has indicated that the transport of neutral beams through conductance limited drift ducts can induce exponentiating beam loss and subsequent beam blocking. Evidence indicates that beam loss on the drift duct wall causes thermally induced outgassing of absorbed hydrogen gas. Application of such a model will be shown to yield predictions which agree both in magnitude and time dependence with the observed results. Further application of such modeling to Doublet III at General Atomic Company will also be discussed.

9350 (ORNL/TM—6360) **Performance of a modified DuoPIGatron ion source for PLT neutral beam injectors.** Tsai, C.C.; Stirling, W.L.; Haselton, H.H. (Oak Ridge National Lab., TN (USA)). Sep 1978. Contract W-7405-ENG-26. 25p. Dep. NTIS, PC A02/MF A01.

The performance of a modified duoPIGatron ion source for PLT neutral beam injectors is described. The 22-cm source has been operated to deliver beams of 70 A, up to 45 keV, and 0.5 sec. Following a brief review of source operation, the dominant reactions

leading to an enhanced atomic ion fraction in the source plasma are emphasized. In addition to the high atomic ion species yield (about 85%), other important characteristics of the source such as high arc efficiency (about 1.1 A ion beam current per kW of arc power), long filament lifetime, high reliability, and scalability are also described.

9351 (UCRL—81086) **Ion trajectories of the MFTF unshielded 80-keV neutral-beam sources.** Ling, R.C.; Bulmer, R.H.; Cutler, T.A.; Foote, J.H.; Horvath, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 May 1978. Contract W-7405-ENG-48. 19p. (CONF-781024—1). Dep. NTIS, PC A02/MF A01.

From CUBE symposium abstracts; Los Alamos, NM, USA (4 Oct 1978).

The trajectories of ions from the Magnetic Fusion Test Facility (MFTF) 80-keV neutral-beam sources are calculated to obtain a preliminary understanding of the ion-beam paths and the magnitude of the power densities. This information will be needed for locating and designing thermal (kinetic-energy) absorbers for the ions. The calculations are made by employing a number of previously written computer codes. The TIBRO code is used to calculate the trajectories of the ions in the fringe magnetic field of the MFTF machine, which can operate with a center-field intensity of up to 2 T. The SAMPP code gives three-dimensional views of the ion beams for better visualization of the ion-beam paths. Also used are the codes MIG, XPICK, and MERGE, which were all previously written for manipulating data.

9352 **Calculation of plasma and reactor parameters for catalyzed D tokamak fusion reactor.** Nakashima, H.; Ohta, M.; Kubota, M. (Kyushu Univ, Fukuoka, Jpn). *Mem. Fac. Eng., Kyushu Univ.;* **37**: No. 3, 133-155(Oct 1977).

Plasma and reactor parameters of tokamak fusion reactors operating on catalyzed deuterium (Cat. D) cycle are calculated on a self-consistent basis with the aim of providing the basic data for the design study. Plasma and reactor parameters have been calculated on a self-consistent basis. The parameters considered include plasma current and toroidal magnetic field. 12 refs.

TRITIUM PROCESSING, ENVIRONMENT AND SAFETY

9353 (CONF-771155—P1, pp 123-143) **Status of Westinghouse tokamak hybrid studies.** Rose, R.P. (Westinghouse Electric Corp., Pittsburgh). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume I.

A brief summary is given of the tokamak hybrid design activities in progress at Westinghouse during this period of time. The principal study programs involving hybrid fusion-fission systems are as follows: fusion-driven actinide burner design study, tokamak breeder design study (U-Pu fuel cycle), laser fusion hybrid study, T-20 blanket test module layout, and tokamak hybrid breeder design study (Th-U fuel cycle). (MOW)

9354 (CONF-771155—P2, pp 425-440) **Environmental and safety aspects of fusion—fision hybrids.** Holdren, J.P. (Univ. of California, Berkeley). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

The environmental and safety aspects of hybrids are discussed with respect to fuel supply, energy cost, timing, systems compatibility, environment and safety, and diversity. (MOW)

9355 **Symbiotic system of a fusion and a fission reactor with very simple fuel reprocessing.** Blinkin, V.L.; Novikov, V.M. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Ehnergii SSSR, Moscow. Inst. Atomnoi Ehnergii). *Nucl. Fusion;* **18**: No. 7, 893-900(1978).

The authors consider a symbiotic fusion and fission reactor system which ensures the breeding of nuclear fuel. In the blanket of the fusion reactor, ^{233}U is produced from thorium circulating in the form of ThF_4 in a mixture of sodium and beryllium fluoride melts. The molten-salt fission reactor burns the ^{233}U and produces, for the fusion reactor, tritium from lithium circulating through its core in the form of LiF mixed with BeF_2 and $^{233}UF_4$. If the ratio of the thermal capacities of the fusion and the fission reactor is 1:11, the system will generate electric power and breed fuel with a doubling time of 4-5 years. The system has the following special features: 1) Much simpler and cheaper fuel reprocessing than with present fission reactors. Reprocessing consists merely of constantly removing ^{233}U from the salt circulating in the fusion reactor blanket by fluorination and removing xenon from the fuel salt of the molten-salt reactor by gas purging. The fuel salt of the molten-salt reactor is renewed periodically and the ^{233}U extracted from it. 2) Tritium production takes place in the fission reactor, which is a simpler system than the fusion reactor. 3) The fusion reactor blanket is almost "clean": tritium is not produced in it and the fission fragment activity does not exceed the activity induced in the structural materials. 4) Virtually all the thorium in the fusion reactor blanket can be used for producing ^{233}U.

INERTIAL CONFINEMENT TECHNOLOGY

REFER ALSO TO CITATION(S) 8643, 8680, 8713, 9242, 9334, 9367, 9368

9356 (CONF-771155—P2, pp 485-501) **Commercialization requirements for inertial confinement fusion.** Booth, L.A.; Bohachevsky, I.O. (Los Alamos Scientific Lab., NM). Jul 1978.

From 2. DMFE hybrid reactor meeting; Washington, DC, USA (2 Nov 1977).

In Proceedings of the second fusion—fission energy systems review meeting. Volume II.

Analyzed are the requirements for commercialization of Inertial Confinement Fusion (ICF) and the nature of the ICF Program. The analysis shows that the requirements are of two kinds: scientific advances and technological developments. Detailed examination of each kind reveals that progress in the ICF Program is currently determined by the advances in basic investigations of not yet sufficiently well understood areas of physics. The technology developments, however, are straightforward although challenging and some require long lead times. For successful commercialization of ICF the long lead time technology developments can, and should, be compatibly integrated into the ICF Program in parallel with the research efforts.

9357 (UCRL—80367) **Reactor group contribution to heavy ion fusion workshop.** Maniscalco, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Nov 1977. Contract W-7405-ENG-48. 11p. (CONF-771073—15). Dep. NTIS, PC A02/MF A01.

From Heavy ion fusion workshop; Upton, NY, USA (17 Oct 1977).

This paper discusses the current status of reactor design for heavy ion fusion.

9358 (UCRL—81269) **Modified diamond dies for laser applications.** McWilliams, R.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Jun 1978. Contract W-7405-ENG-48. 35p. (CONF-781031—1). Dep. NTIS, PC A03/MF A01.

From 48. convention of the Wire Association; St. Louis, MO, USA (15 Oct 1978).

A modified wire drawing die for spatial filtering techniques is described. It was designed for use in high power laser systems. The diamond aperture is capable of enduring high intensity laser frequency without damaging the laser beam profile. The diamond is mounted at the beam focus in a vacuum of 1×10^{-5} Torr. The vacuum prevents plasma forming at the diamond aperture, thus enabling the beam to pass through without damaging the holder or aperture. The spatial filters are fitted with a manipulator that has three electronic stepping motors, can position the aperture in three orthogonal directions, and is capable of 3.2 μm resolution. Shiva laser system is using 105 diamond apertures for shaping the High Energy Laser Beam.

9359 **Advance in physics of laser thermonuclear fusion.** Afanasev, J.; Basov, N.; Gamalij, J.; Krokhin, O.; Rozanov, V. *Veda Tech. SSSR;* **5**: No. 5, 11-18(Oct 1977). (In Czech).

A survey is given of current advance in the physics of laser thermonuclear fusion (LTF). The LTF physical model is discussed with regard to the optimal laser-target systems not only for attaining the physical limit but also for future thermonuclear reactors. The basic physical principles of LTF are formulated which make use of the fact that in focusing laser radiation on the surface of a substance a high density may be attained of the energy flux (10^5 to 10^6 J) and thereby also a high velocity of energy release in the substance. A detailed description is given of the processes which take place in laser irradiation of a spherical target. The problem is discussed of hydrodynamic stability in the compression of matter in laser thermonuclear targets, the concept is explained of the physical threshold of a thermonuclear reaction in laser excitation as are the conditions for attaining this threshold. The quantitative criterion is examined of the attainment of the physical threshold of LTF for pulsed systems.

9360 **Powerful lasers for thermonuclear fusion.** Basov, N.; Krokhin, O.; Sklizkov, G.; Fedotov, S. *Veda Tech. SSSR;* **5**: No. 5, 35-45(Oct 1977). (In Czech).

The parameters are discussed of the radiation of powerful lasers (internal energy of the plasma determined by the volume, density and temperature of the plasma, duration of the heating pulse, focusing of the laser pulse energy in a small volume of matter, radiation contrast) for attaining an effective thermonuclear fusion at minimum microexplosion energy. A survey is given of the methods of shaping laser pulses with limit parameters, and the principle of the construction of powerful laser systems is described. The general

diagram and parameters are given of the Delfin thermonuclear apparatus and a diagram is presented of the focusing system of high luminosity for spherical plasma heating using spherical mirrors. A diagram is presented of the vacuum chamber and of the complex diagnostic apparatus for determining the basic parameters of thermonuclear plasma in the Delfin apparatus. The prospects are indicated of the further development of thermonuclear laser apparatus with neodymium and CO_2 lasers.

9361 Theory of CO_2-laser induced x-ray emission from high density gaseous targets. Krishnan, S. (Indian Inst. of Science, Bangalore. Div. of Physics and Mathematical Sciences). *Proc. Indian Acad. Sci., Sect. A;* **86**: No. 2, 209-216(Aug 1977).

A theory is presented to explain the experimentally observed X-ray emission when a CO_2 laser interacts with a high density hydrogen plasma. To begin with, a dispersion relation is derived for the electromagnetic modes propagating in the plasma system. The saturation level of the mode is determined. It is observed that the saturation energy increases with increasing density. For low densities, X-rays cannot be observed; some where near the critical density the emission rises rapidly. It exhibits a peak before it saturates off with higher densities. The disagreement between theory and observations is discussed.

9362 Spontaneously generated magnetic field in a laser produced plasma. Cojocaru, E. (Institutul Central de Fizica, Bucharest (Romania)). *Stud. Cercet. Fiz.;* **29**: No. 5, 443-453(1977). (In Romanian).

It was deduced by experimental and theoretical ways that intense magnetic fields of the megagauss order can be spontaneously generated in the powerfull laser produced plasmas. In this work, the conditions considered to be responsible for the appearance of these intense magnetic fields, their effects into the laser produced plasma and the methods frequently used for their estimate by experimental way, are shortly discussed.

9363 Pulsed power ion accelerators for inertially confined fusion. Kreig, L.O. *Fiz. Plazmy;* **3**: No. 3, 465-486(1977). (In Russian).

This is a present state survey of accelerating technology for intensive ion beams production. Brief consideration is given to the conditions of beam thermonuclear fusion (energies and particle powers) and also to the principal mechanisms of the particle energy transfer to a target. Ion diodes and collective accelerators are discussed and compared with conventional accelerators. It is shown that the ion diodes producing intensive beams of protons or light ions are more promising for the thermonuclear experiments demonstration. The parameters of heavy ion collective accelerators, if they are to be used for the same purpose, should by heightened. It is also shown that it is possible to focus heavy ion beams at great distances that supports the conception of a heavy ion thermonuclear reactor.

COMPONENT DEVELOPMENT AND MATERIALS TESTING

REFER ALSO TO CITATION(S) 8622

9364 (BNWL-SA—6479) **Potential lithium requirements for fusion power plants.** Hartley, J.N.; Gore, B.F.; Young, J.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1977. Contract EY-76-C-06-1830. 32p. (CONF-7710171—2). Dep. NTIS, PC A03/MF A01.

From Symposium on lithium needs and resources; Corning, NY, USA (12 Oct 1977).

A discussion of lithium requirements and supply suggests that the lithium usage anticipated by the developing fusion power industry may require lithium production well beyond current production growth rates. Present U.S. lithium resources appear sufficient, however, and it is expected that the costs of increasing lithium production would be within acceptable costs for fusion power plants. Careful planning will be required to manage possible problems in obtaining adequate lithium production capacity.

9365 (COO—4540-1(Vol.1)) **Technical assessment of vanadium-base alloys for fusion reactor applications. Volume I. Assessment of data base, needs and recommendations. Final report.** Gold, R.E.; Harrod, D.L.; Ammon, R.L.; Buckman, R.W. Jr.; Svedberg, R.C. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Fusion Power Systems Dept.). Apr 1978. Contract EC-77-C-02-4540. 57p. Dep. NTIS, PC A04/MF A01.

A technical assessment of vanadium and vanadium-base alloys for fusion reactor applications has been carried out. The major objective of this assessment was the development of an informed basis of understanding of the chemical, mechanical, and irradiation response characteristics of vanadium alloys. Efforts were focused on several separate, but interrelated, program tasks. First, a detailed review and analysis of the pertinent technical literature was carried out. Properties which were emphasized were those believed to be most important to making judgments of the viability of vanadium alloys as candidate fusion reactor strucutral materials. The next task reviewed the technical data bases, and methods and assumptions related to their use, which have been factored into life/performance analyses. The critical data gaps/priority needs necessary for these analyses are documented. Finally, criteria are suggested, and test/evaluation procedures recommended, pertinent to judging relative performance levels of vanadium alloys during future alloy development activities. Compositional and metallurgical variables recommended for investigation during such future activities are also presented.

9366 (LBL—7941) **Radiation-induced degassing of cryopumps.** Graham, W.G.; Ruby, L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1978. Contract W-7405-ENG-48. 7p. (CONF-781105—18). Dep. NTIS, PC A02/MF A01.

From ANS meeting; Washington, DC, USA (12 Nov 1978).

The pressure-gauge response of the system to the TRIGA pulses is shown. With an unloaded cryopump, an apparent pressure pulse is produced which is only slightly longer than the reactor pulse itself. In separate experiments, it was found that a similarly appearing pulse is produced by a completely sealed-off vacuum gauge. With a deuterium-loaded cryopump, a very much larger pressure pulse was produced, which had a long exponential tail, characteristic of a repumpdown of the system. The pumping speed, as computed from the exponential, is about half that observed previously when the cryopump was subjected to D_2-gas pulses, in the absense of radiation. Additional experiments were run with the core of the reactor retracted somewhat into the pool, in order to change the mix of gamma rays, thermal neutrons, and fast neutrons so as to preferentially depress the latter.

9367 (UCRL—81206) **Materials considerations for inertially-confined fusion reactors (ICFR).** Hovingh, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jun 1978. Contract W-7405-ENG-48. 33p. (CONF-7806114—1). Dep. NTIS, PC A03/MF A01.

From Faculty Institute, Inertial Confinement Fusion; Argonne, IL, USA (5 Jun 1978).

This paper discusses some of the material considerations for inertially confined fusion reactors. A comparison of the material considerations for inertially confined reactors is made with those of magnetically confined reactors. The lithium fall reactor concept is used as an example of the freedom from constraints intrinsic to inertially-confined fusion reactors.

9368 (UWFDM—250) **Newest frontier in radiation damage research: laser fusion reactors.** Kulcinski, G.L. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Jun 1978. Contract ES-77-S-02-4296. 14p. (CONF-780508—76). Dep. NTIS, PC A02/MF A01.

From 3. meeting on the technology of controlled thermonuclear fusion; Santa Fe, NM, USA (9 May 1978).

The completely different radiation environment in laser fusion facilities compared to that anticipated in magnetic fusion devices, or presently found in current fission reactors, will open up new areas of solid-state research. The pulsed nature of the damage, the unique spectrum of high energy neutrons and the addition of high fluxes of charged particles and X-rays is shown to combine to produce an environment never before faced by materials scientists. This article illustrates these unique features by analyzing a pellet spectra that might be typical of a 100 MJ yield from complex pellet design. The thermal, displacement rate, transmutation rate, and stress response of various materials to this spectra is given. It is shown that the synergistic effects of the high temperature and high charged particle flux can cause enhanced sputtering. The role of gases in protecting the first walls is also discussed and it is shown that roughly 5 to 10 torr-meters of neon gas can effectively reduce the thermal impulses and radiation damage rates in the first walls.

GENERAL AND MISCELLANEOUS

MANAGEMENT

REFER ALSO TO CITATION(S) 8913

MATHEMATICS AND COMPUTERS

REFER ALSO TO CITATION(S) 8367, 8668, 9152

9369 (BNL—24679) **Recent developments in the computer generation of Student's and gamma random variables.** Kinderman, A.J.; Monahan, J.F. (California State Univ., Northridge (USA). Dept. of Management Science; Brookhaven National Lab., Upton, NY

(USA)). Jul 1978. Contract EY-76-C-02-0016. 20p. (CONF-780802—6). Dep. NTIS, PC A02/MF A01.

From American Statistical Association meeting; San Diego, CA, USA (14 Aug 1978).

In the last few years, several new algorithms have appeared in the literature for generating either Student's t or gamma variables. For both distributions, the authors have developed a new algorithm based on their method of representing random variables as the ratio of two uniform variables. All of the algorithms are compared on the bases of speed, portability, and simplicity. Among the algorithms considered are those of Atkinson; Atkinson and Pearce; Cheng; Kinderman, Monahan, and Ramage; and Tadikamalla. 2 tables.

9370 (BNL—24917) **Study on variable transformation from Poisson to normal.** Kao, S.C. (Brookhaven National Lab., Upton, NY (USA)). 1978. Contract EY-76-C-02-0016. 4p. (CONF-780802—8). Dep. NTIS, PC A02/MF A01.

From American Statistical Association meeting; San Diego, CA, USA (14 Aug 1978).

The question of transforming a Poisson variable to a normally distributed variable has been considered in several papers. The proposed transformations were designed to treat Poisson regression problems. For their transformations to be desirable, they should, among other things, make the variance of the variable obtained after transformation more nearly constant for all parameter values in the parameter space. However, this characteristic is not necessary in hypothesis testing upon a Poisson variable as well as in approximating the Poisson distributions with the standard-normal table. This work shows that in such situations there are better transformations than these already proposed in the literature. A theoretical basis for the new transformations is given by investigation of the Taylor expansion of the traditional transformations, and some comparisons on the "goodness" of the transformations are made by using several popular quantitative criteria. 3 tables. (RWR)

9371 (LA—7388-MS) **Standard File Transport protocol.** Chorn, G.E.; Christman, R.D.; Klingner, C.T. (Los Alamos Scientific Lab., NM (USA)). Aug 1978. Contract W-7405-ENG-36. 29p. Dep. NTIS, PC A03/MF A01.

The Standard File Transport is the method used to ship files between the components of the Los Alamos Scientific Laboratory's Integrated Computer Network. In this report the basic file transport protocol; the special features, such as parameter negotiation and recovery, that are essential to successful file shipping in a network; and details of the file transport requests and responses are discussed. 8 figures, 1 table.

9372 (SAND—78-1189) **SLATEC Common Mathematical Library error handling package.** Jones, R.E. (Sandia Labs., Albuquerque, NM (USA)). Sep 1978. Contract EY-76-C-04-0789. 48p. Dep. NTIS, PC A03/MF A01.

As part of an effort to develop an interlaboratory mathematical subroutine library, the SLATEC Common Math Library Subcommittee developed an error handling package. This package of routines provides a flexible central capability through which all errors detected by FORTRAN library routines can be communicated to the user. The history of this development is given, and the features of the package are discussed. Usage descriptions of the resulting routines are given in detail, along with examples and the listings of the error handling routines. 1 figure.

9373 (SAND—78-1319) **Microprocessor controlled data acquisition system.** White, R.L. (Sandia Labs., Albuquerque, NM (USA)). Aug 1978. Contract EY-76-C-04-0789. 30p. Dep. NTIS, PC A03/MF A01.

Use of a microprocessor with an automatic data collection system allows system function and data formats of input and output to be changed with minimal hardware changes. A general purpose system that can be used for a variety of applications is described. Most of the components for this system are available commercially at reasonable cost, and a similar system could be constructed with a minimum of time and effort. 7 figures. (RWR)

9374 (UCID—17900) **Short films from the Topology Films Project.** Max, N.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Aug 1978. Contract W-7405-ENG-48. 32p. Dep. NTIS, PC A03/MF A01.

This report describes a series of 17 short, computer-animated films produced by the Topology Films Project, supported by the National Science Foundation. The films, distributed by the International Film Bureau, illustrate the concepts of limit and space-filling curves, sphere eversions, and other topological theories.

9375 (UCID—17927) **EZVECS: macros for vector programs.** Dubois, P.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1978. Contract W-7405-ENG-48. 18p. Dep. NTIS, PC A02/MF A01.

LLL's Fortran language "LRLTRAN" contains vector syntax extensions. With these one can write vector routines that take advantage of the architecture of these machines to achieve greater speed. However, the available syntax can be difficult to understand and use, difficult to transport between machines, and prone to frequent errors when introducing new vectors into a code. The macros presented ease this burden. A user can easily learn to write transportable vector code. The emphasis is on simplicity of use. The package has the benefit of giving the user a uniform vector language and a reduction in debugging problems. (RWR)

9376 (UCID—17937(Pt.2)) **PPOS: a master control data base preprocessor, a description and explanation of the DNA project data base development.** Chato, D.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Aug 1978. Contract W-7405-ENG-48. 44p. Dep. NTIS, PC A03/MF A01.

Field Command, DNA Military Liaison Office requires data management of 20,000 to 40,000 lines of information per year. Each line represents a weapon movement from one site to another. Analysis of weapon transactions provides the basis for a major weapons cost study at DNA. One of the initial problems was that the incoming data were not in data base format and required extensive manipulation before records based on some logical scheme could be generated. A preprocessor, PPOS, was written to investigate and process the raw transactions data. The preprocessor was designed to build the data base and generate the records. After the data base has been created, Master Control is used to operate on the data base and to supply reports. (RWR)

9377 (UCRL—81636) **Array processing on the PDP-10.** Maron, N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Aug 1978. Contract W-7405-ENG-48. 7p. (CONF-780945—1). Dep. NTIS, PC A02/MF A01.

From Workshop on vector and parallel processors; Los Alamos, NM, USA (20 Sep 1978).

Array Processors have been on the market for a number of years. They could offer a cost effective way to enhance the floating point number capability of a PDP-10. The results of attaching one such device to the M-division PDP-KI10 of Lawrence Livermore Laboratory are reported. An evaluation of the library software delivered with the array processor, as well as the operating system overhead, is presented. 2 figures, 1 table.

9378 **Symmetrical addition formula for the Laguerre polynomials.** Durand, L. (Univ. of Wisconsin, Madison). *SIAM J. Math. Anal.;* **8**: No. 3, 541-546(May 1977).

A symmetrical addition formula is presented for the general Laguerre polynomials L/sub n//sup α/(Z) with argument $Z = x + y + 2\sqrt{(xy)}rt - xyr^2$. The formula involves a finite sum of Laguerre and Hermite polynomials, and can be integrated to give a new product formula for L/sub n//sup α/(x)L/sub n//sup α/(y). This addition formula is obtained as a limiting case of Koornwinder's addition formula for the Jacobi polynomials.

9379 **Tests for departure from normality: comparison of powers.** Pearson, E.S. (University Coll., London); D'agostino, R.B.; Bowman, K.O. *Biometrika;* **64**: No. 2, 231-246(1977).

A large-scale simulation study of the power of various tests of normality is reported. A considerable variety of tests were applied to samples drawn from a wide range of nonnormal populations. The difference between "omnibus" and "directional" tests is emphasized; and the difficulty of applying tests based on ordered observations, such as the Shapiro—Wilk test, when in practice the sample data may contain "ties" resulting from grouping or rounding, is shown. 2 figures, 9 tables.

INFORMATION HANDLING

9380 (BNL—50840) **Medical data base: a tool for studying the relationship of energy-related pollutants to ill health.** Bozzo, S.R.; Galdos, F.; Novak, K.M.; Hamilton, L.D. (Brookhaven National Lab., Upton, NY (USA). National Center for Analysis of Energy Systems). Mar 1978. Contract EY-76-C-02-0016. 347p. Dep. NTIS, PC A15/MF A01.

The Medical Data Base (MEDABA) was developed to facilitate the examination of the effects of energy-related pollutants on ill health. Since both geographical as well as statistical considerations place certain requirements on the development of such a data base, the county was chosen as the basic unit of analysis. The file was organized in such a manner to permit the aggregation of data in as many ways as possible, thus maximizing its usefulness in serving a wide and varied number of specific research objectives. The data base is described, and one of its specific uses as a research tool discussed in the light of the development of a population dynamic and mortality effects model. Input data for this model produced by MEDABA is presented in accompanying tables.

9381 Uses and benefits of technical information systems. Wolek, F.W. (University City Science Center, Philadelphia). *Res. Manage. (N.Y.);* **20**: No. 5, 37-41(Sep 1977).

While scientific and technical information (STI) systems have been growing rapidly in number, quality, and usefulness, R and D organizations have not yet taken advantage of their full potential. This article explains how to make effective use of the latest STI systems.

CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Aerochem Research Labs., Inc., Princeton, NJ (USA)
Synthesis of silane and silicon in a non-equilibrium plasma jet. Seventh quarterly report, February 1—April 30, 1978, 4:7674 (DOE/JPL/954560—7)

AiResearch Mfg. Co., Torrance, CA (USA)
Near-term electric vehicle program. Phase II: mid-term summary report, 4:8546 (SAN—1213-02)
Prototype solar heating and cooling systems, 4:7714 (DOE/NASA/CR—150570)

Allied Chemical Corp., Idaho Falls, ID (USA)
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Remotely replaceable fuel and feed nozzles for the NWCF calciner vessel, 4:7503 (CONF-781105—44)

Allied Chemical Corp., Idaho Falls, ID (USA). Idaho Chemical Programs - Operations Office
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Installation package for integrated programmable electronic controller and hydronic subsystem: solar heating and cooling, 4:7728 (DOE/NASA/CR—150747)

Argonne National Lab., IL (USA)
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Suggested non-proliferation criteria for commercial nuclear fuel cycles, 4:7520 (CONF-780622—66)

Atomics International Div., Canoga Park, CA (USA)
Sodium technology and cover gas seal development programs. Quarterly technical progress report, April—June 1978, 4:8073 (ESG-DOE—13239)

Atomics International Div., Golden, CO (USA). Rocky Flats Plant
New approach for safeguarding enriched uranium hexafluoride bulk transfers, 4:7522 (RFP—2757)

Avco-Everett Research Lab., Everett, MA (USA)
Visible laser energy transfer study. Final technical report, 4:8708 (COO—2811-1)

Avco-Everett Research Lab., Inc., Everett, MA (USA)
Metal vapor excimer laser. Quarterly progress report, August 1, 1977—October 31, 1977, 4:8711 (COO—4275-2)
Metal vapor excimer laser. Quarterly progress report, February 1, 1978—April 30, 1978, 4:8712 (COO—4275-4)

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Battelle Columbus Labs., OH (USA)
Determination and microscopic study of incipient defects in irradiated power reactor fuel rods. Final report, 4:7964 (EPRI-NP—812)
Experimental studies of dynamic impact response with scale models of lead shielded radioactive material shipping containers, 4:8695 (BMI—2001)

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Prototype Large Breeder Reactor: Phase II extension. Volume I. Conceptual design studies, 4:8080 (TID—28758)
Bendix Corp., Kansas City, MO (USA)
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Bendix Field Engineering Corp., Grand Junction, CO (USA)
Monitoring of the airport calibration pads at Walker Field, Grand Junction, Colorado for long-term radiation variations, 4:7450 (GJBX—99(78))
Procedures and regulations for airport calibration pads, Walker Field, Grand Junction, Colorado, 4:7448 (GJBX—38(78))
Bickle (Larry W.) and Associates, Albuquerque, NM (USA)
Estimation of transient measurement errors, 4:8951 (SAND—78-0497)
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Improved semiconductors for photovoltaic solar cells: $CuInSe_2$. Final progress report, June 18, 1976—July 18, 1977, 4:7682 (TID—28572)
Brigham Young Univ., Provo, UT (USA)
Alloy catalysts with monolith supports for methanation of coal-derived gases. Quarterly technical progress report, December 21, 1977—March 20, 1978, 4:7208 (FE—2729-2)
Brookhaven National Lab., Upton, NY (USA)
Advanced thermohydraulic simulation code for transients in LMFBRs (SSC-L code), 4:8261 (BNL-NUREG—50773)
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Environmental control technology for atmospheric carbon dioxide. Progress report No. 2, October 1, 1977—March 31, 1978, 4:8855 (BNL—50877)
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Medical data base: a tool for studying the relationship of energy-related pollutants to ill health, 4:9380 (BNL—50840)
Brown Univ., Providence, RI (USA). Div. of Engineering
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Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Investigation of methods for the degassing of primary coolant water, 4:7998 (BMFT-FB-K—77-08)
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California State Univ., Northridge (USA). Dept. of Management Science
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Documentation for program OGRE, 4:7883 (LBL—7060)
Energy management: a program of energy conservation for the community college facility, 4:8403 (LBL—7813)
Geothermal and Geosciences program. Annual report, 1976, 4:7881 (PUB—225)
LBL—7599, 4:8830 (CONF-7806110—1)
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Plant engineers solar energy handbook, 4:7736 (LLL/M—086(Rev.1))
PPOS: a master control data base preprocessor, a description and explanation of the DNA project data base development, 4:9376 (UCID—17937(Pt.2))
Precision machine-tool program. Quarterly report, May—June 1978, 4:8674 (UCRL—50053-78-2)
Precision-machining commercialization. Quarterly report, May—July 1978, 4:8675 (UCRL—50054-78-2)
Reactor group contribution to heavy ion fusion workshop, 4:9357 (UCRL—80367)
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U. S. Mirror Program, 4:9325 (UCRL—81555)
Using PARET (parameter estimation technique) for the determination of mode shapes, 4:8673 (UCID—17898)

Calmac Mfg. Corp., Englewood, NJ (USA)
Liquid flat plate collector and pump for solar heating and cooling systems (a collection of quarterly reports), 4:7853 (DOE/NASA/CR—150599)

Carnegie-Mellon Univ., Pittsburgh, PA (USA)
Design report for PS-105 data acquisition system for biofouling studies of heat exchangers in seawater, 4:7699 (COO—4041-6)
Studies in support of recirculating bed reactors for the processing of coal. Semi-annual report, September 1, 1977—March 30, 1978, 4:7183 (FE—2449-6)

CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)
DISTAV calculation code for determining sodium temperatures in deformed helicoid wire pin bundles in fast neutron reactors, 4:8082 (ANL-Trans—1140)

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)
Objectives of programs for renovating and increasing the power of research reactors, 4:8232 (ANL-Trans—1139)

City Coll., New York (USA)
Improved techniques for gasifying coal. Fifth quarterly report, July 1—September 30, 1977, 4:7206 (FE—2340-5)

Clarkson Coll. of Tech., Potsdam, NY (USA). Dept. of Physics
Fluorescent scattering by molecules embedded in small particles. Progress report, May 1, 1977—October 31, 1978, 4:8987 (COO—4361-1)

Clark Univ., Worcester, MA (USA)
Grid-connected integrated community energy system. Final report, August 9, 1977—March 22, 1978. Volume I, Phase II, 4:8401 (COO—4211-3/1)

Clemson Univ., SC (USA)
Effects of irradiation on the copper normal metal of a composite superconductor, 4:8622 (CONF-780952—2)

Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science
Interannual variability of the ocean atmosphere system, 4:8853 (COO—1340-64)
Simplification of building census input for a physical model of space-heating demands, 4:8445 (COO—1340-62)

Colorado State Univ., Fort Collins (USA). Dept. of Microbiology
Microbial production of aliphatic hydrocarbons. Progress report, August 1, 1977—July 31, 1978, 4:7597 (COO—4478-1)

Combustion Engineering, Inc., Windsor, CT (USA)
Burnable poison irradiation test, 4:7999 (CEN—50(Rev.1A))
Fluidized bed industrial boiler, 4:8793 (TIS—5764)

Commission of the European Communities, Ispra (Italy). Joint Research Centre
Prediction for the high-level alpha-active waste to be generated by nuclear power stations in the Member States of the European Communities, 4:7506 (EUR—5690)

Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements
Employment of a completely automated mass spectrometer in fissile material control, 4:7521 (KFK—2319)

Consolidated Edison Co. of New York, Inc., New York (USA)
PWR steam generator chemical cleaning. Phase I, final report: solvent and process development. Volume I, 4:8000 (COO—4325-1)

Contemporary Systems, Inc., Jeffrey, NH (USA)
Design data brochure for CSI series V solar heating system, 4:7721 (DOE/NASA/CR—150600)
Preliminary design package for prototype solar heating system, 4:7723 (DOE/NASA/CR—150615)
Schedules, technical status, and program activities in the development of a single family solar space heating system, 4:7715 (DOE/NASA/CR—150571)

Crystal Systems, Inc., Salem, MA (USA)
Heat exchanger method, ingot casting; fixed abrasive method, multi-wire slicing. Phase II. Silicon sheet growth development for Large Area Sheet Task of the Low Cost Silicon solar Array Project. Quarterly progress report No. 3, April 1—June 30, 1978, 4:7672 (DOE/JPL/954373—7)

D

Daedalean Associates, Inc., Woodbine, MD (USA)
Results of the initial feasibility program on cavitation descaling techniques for pipes and tubes used in geothermal energy plants, 4:7903 (HCP/T2289—01)

Dames and Moore, Oak Ridge, TN (USA)
U.S. working draft on repository physical descriptions in a granite formation, 4:7516 (Y/OWI/SUB—78/22340/2)

Department of Energy, Albuquerque, NM (USA). Albuquerque Operations Office
Table of cases decided in the United States Court of Claims: 1863—1975, 4:8412 (ALO—10)

Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center
Preparation of liquids from coals for hydrocarbon-type analysis in relation to refining, 4:7229 (BETC/RI—78/10)

Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office
Steam—water mixing in nuclear reactor safety loss-of-coolant experiments, 4:8264 (CONF-781022—11)

Department of Energy, Morgantown, WV (USA). Morgantown Energy Research Center
Characterization of aerosols produced by an experimental fluidized bed coal combustor operated with sub-bituminous coal, 4:8858 (LF—57)
Solar heating and cooling of buildings (SHACOB) commercialization report, Part A: options and strategies. Volume III. Appendices, 4:7732 (HCP/M70065—01/3)

Department of Energy, Oak Ridge, TN (USA). Technical Information Center
Nuclear quality assurance: a bibliography, 4:7955 (TID—3374)

Department of Energy, Washington, DC (USA)
National program plan for research and development in solar heating and cooling for building, agricultural, and industrial applications, 4:7704 (DOE/CS—0008)

Department of Energy, Washington, DC (USA). Div. of Environmental Control Technology
Division of Environmental Control Technology program, 1977, 4:7269 (DOE/EV—0015)

Department of Energy, Washington, DC (USA). Div. of Transportation Energy Conservation
Electric and hybrid vehicle program. Quarterly report, April—June 1978, 4:8537 (DOE/CS—0026/3)

Department of Energy, Washington, DC (USA). Energy Information Administration
Gas-turbine electric plant construction cost and annual production expenses, 1974: second annual report, 4:8427 (DOE/EIA—0048/1)
Department of Energy, Washington, DC (USA). Office of Fusion Energy
Proceedings of the second fusion—fission energy systems review meeting. Volume I, 4:9308 (CONF-771155—P1)
Proceedings of the second fusion—fission energy systems review meeting. Volume II, 4:9313 (CONF-771155—P2)
Department of Energy, Washington, DC (USA). Office of Health and Environmental Research
Workshop on research needs in actinide biology, 4:8929 (CONF-770491—)
Department of Energy, Washington, DC (USA). Office of Weatherization Assistance Programs
Home weaterization instructor's guide. Project RetroTech, 4:8459 (DOE/CS—0040/1)
Home weatherization charts. Project Retro Tech, 4:8460 (DOE/CS—0040/4)
Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.
^{238}Pu fuel form processes. Monthly report, January—February 1978, 4:7536 (DPST—78-128-1/2)
Radiation-induced iodine migration in silver zeolite beds, 4:7505 (DP-MS—78-5)
Duquesne Univ., Pittsburgh, PA (USA). Dept. of Chemistry
Hydrogen bonding in asphaltenes and coal. Final report, 4:7248 (TID—28507)

E

EG and G Idaho, Inc., Idaho Falls (USA)
Analysis of a simulated small break in the semiscale system under loss-of-coolant accident conditions, 4:8267 (CONF-781022—17)
Effect of reflood prediction uncertainties on LOFT cladding oxidation, 4:8273 (CONF-781105—34)
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EG and G, Inc., Goleta, CA (USA)
Forward and backward stimulated Raman scattering in a multimode fiber, 4:9222 (CONF-780688—2)
Elcam, Inc., Santa Barbara, CA (USA)
Preliminary design package for sunspot domestic hot water heating system, 4:7775 (DOE/NASA/CR—150605)
Prototype solar heated hot water systems an double-walled heat exchanger (a collection of quarterly reports), 4:7774 (DOE/NASA/CR—150591)
Electric Power Research Inst., Palo Alto, CA (USA)
Turbine-missile casing exit tests, 4:8289 (SAND—78-1343C)
Energy Technology Engineering Center, Canoga Park, CA (USA)
Sodium—water reaction test in LLTR. Series I. Final report, 4:8074 (ETEC—78-10)
Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.
Fundamental characterization of alternate fuel effects in continuous combustion systems. Technical progress report No. 2, 15 November 1977—14 February 1978, 4:8791 (TID—28868)
Fundamental characterization of alternate fuel effects in continuous combustion systems. Technical progress report No. 3, 15 February 1978—14 May 1978, 4:8792 (TID—28869)
Fundamental characterization of alternate fuel effects in continuous combustion systems. Technical progress report No. 1, August 15, 1977—August 14, 1978, 4:8414 (TID—28463)
Hot corrosion/erosion testing of materials for application to advanced power conversion systems using coal-derived fuels. Task II: fluidized bed combustion. First task report, July 1, 1976—December 31, 1977, 4:7910 (FE—2452-21)

F

Federal Energy Administration, Washington, DC (USA)
Mandatory Canadian crude oil allocation regulations, 4:7354 (DES—76-1)
Federal Energy Regulatory Commission, Washington, DC (USA). Office of Pipeline and Producer Regulation
Commission staff report, 4:7391 (DOE/FERC—0021)
Fermi National Accelerator Lab., Batavia, IL (USA)
Bellcord: a multilevel fast preprocessor for 1024 ECL channels, 4:8840 (CONF-781033—3)
Florida Univ., Gainesville (USA). Inst. of Food and Agricultural Sciences
Sugarcane production residues: technologic and economic assessment of methods for conversion to utilizable energy forms. Final report, 4:7640 (TID—28550)
Ford Motor Co., Dearborn, MI (USA)
Automotive Stirling Engine Development Program. Quarterly technical progress report, January 1978—March 1978, 4:8536 (COO—4396-2)
Foster-Miller Associates, Inc., Waltham, MA (USA)
Development of a flexible shaft roof drilling system. Final report, June 26, 1974—January 15, 1977, 4:7281 (FE—9087-1)

G

General Atomic Co., San Diego, CA (USA)
Dissolution in HTGR fuel reprocessing: interim development report, 4:7481 (GA-A—15092)
Flow-induced vibrations in the 300-MW(e) gas-cooled fast breeder reactor demonstration plant: a scoping study, 4:8276 (GA-A—14700)
Interim development report: engineering-scale HTGR fuel particle crusher, 4:7480 (GA-A—15073)
Measured and predicted beam attenuation in neutral beam drift ducts for tokamaks, 4:9349 (GA-A—15085)
One-fifth-scale and one-half-scale two-dimensional seismic tests, 4:8275 (GA-A—14087)
General Electric Co., Philadelphia, PA (USA). Space Div.
Prototype solar heating and combined heating and cooling systems (quarterly report No.3), 4:7724 (DOE/NASA/CR—150691)
Prototype solar heating and combined heating and cooling systems. Quarterly report No. 4, 4:7725 (DOE/NASA/CR—150692)
Solar heating and cooling system design and development (quarterly summary), 4:7726 (DOE/NASA/CR—150705)
General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center
Household energy conservation system study. Final report, 4:8458 (COO—4058-1)
General Electric Co., San Jose, CA (USA). Boiling Water Reactor Systems Dept.
Subcooled counter-current flow limiting characteristics of the upper region of a BWR fuel bundle, 4:7965 (NEDG—23549)
General Electric Co., Schenectady, NY (USA)
Near-term electric vehicle program. Phase II: mid-term summary report, 4:8546 (SAN—1213-02)
General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.
Intermediate System Mockup Loop (ISML) operation, 4:8075 (GEFR—00373)

Geological Survey, Menlo Park, CA (USA)
Chemical, isotopic, and gas compositions of selected thermal springs in Arizona, New Mexico, and Utah, 4:7893 (USGS-OFR—77-654)
Hot springs of the central Sierra Nevada, California, 4:7891 (USGS-OFR—77-559)
Preliminary catalog of earthquakes in northern Imperial Valley, California, July 1977—September 1977, 4:7884 (USGS-OFR—77-869)
Geological Survey, Reston, VA (USA)
GEOTHERM user guide, 4:7890 (USGS-OFR—77-504)
Geological Survey, Washington, DC (USA)
Audio-magnetotelluric data log, station-location map, and telluric profile for San Emidio Known Geothermal Resource Area, Nevada, 4:7889 (USGS-OFR—75-670)
Deep drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal exploration well No. 2, 4:7894 (USGS-OFR—77-243)
Deep drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal exploration well No. 3 sidetrack-C, 4:7896 (USGS-OFR—77-883)
Deep drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal exploration well No. 3, 4:7895 (USGS-OFR—77-616)
Geology, 4:7449 (GJBX—41(78)Vol.3))
Helium sniffer field test: Roosevelt Hot Springs, Utah, October 1975 and March 1976, 4:7892 (USGS-OFR—77-606)
Preliminary bibliography for the Clear Lake-Geysers area, California, 4:7882 (USGS-OFR—77-489)
Georgetown Univ., Washington, DC (USA)
Industrial application of fluidized-bed combustion. Quarterly technical progress report, April—June 1978, 4:7911 (HCP/T2461—08)
George Washington Univ., Washington, DC (USA). School of Engineering and Applied Science
Handbook of technology assessment. Final report. Volume I, 4:8392 (TID—28503)
Georgia Inst. of Tech., Atlanta (USA). Coll. of Engineering
Solar concentrating collectors, 4:7791 (CONF-770953—)
Georgia Univ., Athens (USA). Dept. of Chemistry
Development of a practical photochemical energy storage system. Annual report, 15 June 1977—14 June 1978, 4:7879 (SRO—893-14)
Effects of operating variables on peak shape in gel permeation chromatography, 4:8646 (SRO—854-21)
Fundamental studies of separation processes. Technical progress report, 4:8647 (SRO—854-22)
Greenmoss Builders, Inc., Waitsfield, VT (USA)
Monthly performance report, 4:7740 (SOLAR/1009—77/12)
Grumman Aerospace Corp., Bethpage, NY (USA)
Preliminary deals magnet system design study for HFITR, 4:9338 (BNL—24904)

H

Hanford Engineering Development Lab., Richland, WA (USA)
Small thermal oscillation analysis of the MOTA, 4:8219 (HEDL-TME—78-12)
Harvard Univ., Cambridge, MA (USA)
Experimental studies of the acoustic detection of particle showers, 4:8841 (COO—3064-010)
Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry
Nature of oxygen containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, September 1977—July 1978, 4:8663 (COO—3221-5)
Honeywell Corporate Material Sciences Center, Bloomington, MN (USA)
Silicon-on-ceramic coating process. Silicon sheet growth development for the Large-Area Silicon Sheet and Cell Development Tasks of the Low-Cost Silicon Solar Array Project. Quarterly report No. 9, March 29—June 30, 1978, 4:7671 (DOE/JPL/954356—6)
Honeywell, Inc., Minneapolis, MN (USA)
Solar heating and cooling systems design and development. Quarterly report No. 4, April 1, 1977—June 30, 1977, 4:7729 (DOE/NASA/CR—150770)
Houston Chemical Corp., Corpus Christi, TX (USA)
Solar heat transport fluid: a quarterly report, 4:7855 (DOE/NASA/CR—150612)

I

IBM Federal Systems Div., Huntsville, AL (USA)
Application of solar energy to air conditioning systems, 4:7709 (DOE/NASA/CR—150532)
Design data brochure: SIMS Prototype System 3, 4:7727 (DOE/NASA/CR—150707)
Design review package for the on-site monitor for solar heating and cooling systems, 4:7720 (DOE/NASA/CR—150590)
Installation package: SIMS prototype system 1A, 4:7708 (DOE/NASA/CR—150524)
Sims Prototype System 2 test results: engineering analysis, 4:7772 (DOE/NASA/CR—150544)
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Site dependent factors affecting the economic feasibility of solar powered absorption cooling, 4:7710 (DOE/NASA/CR—150533)
Site selection feasibility for a solar energy system on the Fairbanks Federal Building, 4:7713 (DOE/NASA/CR—150559)
Site selection for MSFC operational tests of solar heating and cooling systems, 4:7712 (DOE/NASA/CR—150537)
Subsystem design package for Mod II site data acquisition system, solar heating and cooling, 4:7718 (DOE/NASA/CR—150588)
Subsystem design package for the on-site monitor at solar heating and cooling sites, 4:7717 (DOE/NASA/CR—150578)
System design package for IBM system one solar heating and domestic hot water, 4:7722 (DOE/NASA/CR—150614)
Idaho National Engineering Lab., Idaho Falls (USA)
Calculations of flow oscillations during reflood using RELAP4/MOD6, 4:8268 (CONF-781105—5)
Decontamination and decommissioning long range plan: Idaho National Engineering Laboratory, 4:8231 (TREE—1250(Vol.1))
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Selection of a criticality monitoring technique for a transuranic waste incinerator, 4:7515 (TREE—1277)
Semiannual progress report for the Idaho Geothermal Program, October 1, 1977—March 31, 1978, 4:7899 (TREE—1278)
Similarities and differences in vapor explosion criteria, 4:8270 (CONF-781105—19)
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Illinois Univ., Urbana (USA). Office of Energy Research
Fuels from biomass symposium, 4:7684 (COO—4225-1)
Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)
Systematics of fragmentation of Nilsson strength near A = 190, 4:9184 (BNL—24696)
International Atomic Energy Agency, Vienna (Austria)
Replacement of the high enrichment fuel in research piles with low or medium enrichment uranium, 4:8233 (ANL-Trans—1138)
International Business Machines Corp., Huntsville, AL (USA)
Solar energy control system evaluation, 4:7739 (SOLAR/0007—78/22)
Solar energy system performance evaluation. Iris images: interim report, Revision A, 4:7769 (SOLAR/2005—77/14(Rev.A))
Solar energy system performance evaluation: Kalwall Corporation Warehouse, Manchester, New Hampshire, November 1977—April 1978, 4:7748 (SOLAR/2015—78/14)
Thermal performance of the Perk—Mack Enterprises Inc. solar energy system, 4:7744 (SOLAR/1015—78/21)

Thermal performance of the Scattergood School solar energy system, 4:7747 (SOLAR/2003—78/23)
International Nickel Co., Inc., Suffern, NY (USA)
Development and evaluation of high chromium weld deposited overlays to protect less alloyed substrates from corrosion in a coal gasification atmosphere. Technical status report, June 1—July 31, 1978, 4:7207 (FE—2621-4)

J

Jacobs Engineering Co., Pasadena, CA (USA)
Application of solar energy to the supply of industrial hot water. Volume II. Appendix to the final design report, 4:7770 (TID—28745)
Jet Propulsion Lab., Pasadena, CA (USA)
Coal pump development and technical support. Quarterly project report No. 3, 27 February—2 April 1978, 4:7210 (TSR—78/3)
Proceedings of the DOE chemical/hydrogen energy contractor review systems, 4:7538 (CONF-771131—)

K

Kansas Univ., Lawrence (USA). Dept. of Geology
Experimental investigation of the chemistry of excited states of rare gases. Third quarterly progress report, April 15, 1978—July 15, 1978, 4:8650 (COO—2807-14)
Kentucky Univ., Lexington (USA)
Black shale studies in Kentucky. Quarterly report, June 1978, 4:7423 (TID—28867)
Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Radiochemie
Employment of a completely automated mass spectrometer in fissile material control, 4:7521 (KFK—2319)
Kernforschungszentrum Karlsruhe (Germany, F.R.). Projekt Spaltstoffflusskontrolle
Employment of a completely automated mass spectrometer in fissile material control, 4:7521 (KFK—2319)

L

Lehigh Univ., Bethlehem, PA (USA)
Centrifugal fluidized combustion of coal. Quarterly report, January—March 1978, 4:7309 (FE—2516-6)
Life Sciences Engineering, Morrison, CO (USA)
Collation of quarterly reports on air flat plate collectors, 4:7859 (DOE/NASA/TM—150514)
Installation package for air flat plate collector, 4:7850 (DOE/NASA/CR—150536)
Preliminary design review package on air flat plate collector for solar heating and cooling system, 4:7854 (DOE/NASA/CR—150601)
Little (Arthur D.), Inc., Cambridge, MA (USA)
Phase I report: solar assessment study in the support of the International Ekistics Program, 4:8494 (ANL/ICES-TM—12)
Lockheed Missiles and Space Co., Inc., Huntsville, AL (USA). Research and Engineering Center
Analysis and development of regenerated desiccant systems for industrial and agricultural drying. Final report, April—December 1977, 4:8477 (ORNL/SUB—7296/1)
Lockheed Missiles and Space Co., Sunnyvale, CA (USA)
Phase 2, automated array assembly, Task IV Low-Cost Silicon Solar Array Project. Quarterly report No. 2, February 1—April 30, 1978, 4:7679 (DOE/JPL/954898—2)
Los Alamos Scientific Lab., NM (USA)
Analysis of a dc commutator machine for exchange of energy with a superconducting coil, 4:9345 (LA—7447-MS)
Application of artificial intelligence techniques to the acceleration of Monte Carlo transport calculations, 4:9207 (LA—7475-MS)
Brief comparison of the inherent capabilities of conventional controllers and linear-regulator controllers, 4:7735 (LA-UR—78-2280)
Calorimetric fission product decay heat measurements for ^{239}Pu, ^{233}U, and ^{235}U, 4:9190 (NUREG/CR—0349)
Cargo response to railcar impact and tiedown load analysis, 4:8696 (LA—7469-MS)
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Engineering design of a toroidal reversed-field pinch reactor (RFPR), 4:9321 (LA-UR—78-2322)
Explosively produced fracture of oil shale. Progress report, January—March 1978, 4:7425 (LA—7338-PR)
Faraday rotation measurements in high-β fusion experiments, 4:9241 (LA-UR—78-2344)
General-purpose heat source project, space nuclear safety program. Progress report, and radioisotopic terrestrial safety program, 4:7537 (LA—7460-PR)
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Lead isotopes as indicators of environmental contamination from the uranium mining and milling industry in the Grants Mineral Belt, New Mexico, 4:8883 (LA-UR—78-2147)
Low temperature physics and engineering. Quarterly progress report, January 1—March 31, 1978, 4:8684 (LA—7374-PR)
Low Temperature Physics and Engineering quarterly progress report, April 1—June 30, 1978, 4:8636 (LA—7448-PR)
Metric universality in nonlinear recurrence, 4:8886 (LA-UR—78-2211)
Mixing of radiolytic hydrogen generated within a containment compartment following a LOCA, 4:8283 (NUREG/CR—0304)
Neutron diagnostics for pulsed high-β plasmas, 4:9239 (LA-UR—78-2342)
Nuclear reactor safety. Quarterly progress report, 1 January—31 March 1978, 4:8277 (LA—7278-PR)
Plasma transport and flow in the fluid picture, 4:9260 (LA—7429-MS)
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Standard File Transport protocol, 4:9371 (LA—7388-MS)
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Thermoelastic analysis of a superconducting cable, 4:7954 (LA—7465-MS)
Tour of Russian oil field technology, 4:7323 (LA-UR—77-1765)
Los Angeles County Harbor General Hospital, Torrance, CA (USA)
Superconducting Magnetic Energy Storage (SMES) program. Progress report, January 1—December 31, 1977, 4:8329 (LA—7294-PR)
Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA)
Characterization of aerosols produced by an experimental fluidized bed coal combustor operated with sub-bituminous coal, 4:8858 (LF—57)

M

Magnetic Corp. of America, Waltham, MA
Study to assess the feasibility of scaling up the powder metallurgy approach for the fabrication of commercial Nb_3Sn filamentary superconductors, 4:8589 (UCRL—13878)
Martin Marietta Corp., Denver, CO (USA)
Central receiver solar thermal power system, phase I: preliminary design report. Volume VI. Electrical power generation/master control subsystems and balance of plant. Appendixes C-H, 4:7695 (SAN—1110-77-2(Vol.6)(App.C-H))
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Northwestern Univ., Evanston, IL (USA). Transportation Library
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Oklahoma State Univ., Stillwater (USA)
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Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry
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Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.
High efficiency, long life terrestrial solar panel. Final report, September 1, 1977—March 31, 1978, 4:7676 (DOE/JPL/954831—3)

Oregon State Univ., Corvallis (USA). School of Oceanography
Secondary recovery method for the extraction of geothermal energy. Final report consisting of two sections: (1) short review of the technique of forced geoheat recovery from sheet-like fluid conductors; (2) heat transfer effects in forced geoheat recovery systems. Reporting period: July 1, 1976—December 31, 1977, 4:7906 (RLO—2227-T21-3)

Owens-Illinois, Inc., Toledo, OH (USA)
Air—liquid solar collector for solar heating, combined heating and cooling, and hot water subsystems. First quarterly report, November 1, 1976—October 31, 1977, 4:7851 (DOE/NASA/CR—150569)

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Princeton Univ., NJ (USA). Dept. of Aerospace and Mechanical Sciences
Formation and control of fuel-nitrogen pollutants in catalytic combustion of coal-derived gases. Quarterly report, December 15, 1977—March 15, 1978, 4:7191 (FE—2762-3)

Princeton Univ., NJ (USA). Plasma Physics Lab.
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Triangle Universities Nuclear Lab., Durham, NC (USA)
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Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.
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Westinghouse Electric Corp., Pittsburgh, PA (USA)
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Westinghouse Electric Corp., Pittsburgh, PA (USA). Fusion Power Systems Dept.
Technical assessment of vanadium-base alloys for fusion reactor applications. Volume I. Assessment of data base, needs and recommendations. Final report, 4:9365 (COO—4540-1(Vol.1))

Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center
Silicon web process development. Low Cost Solar Array Project. Large Area Silicon Sheet Task. Quarterly report, April 20, 1978—June 30, 1978, 4:7675 (DOE/JPL/954654—4)

Westinghouse Hanford Co., Richland, WA (USA)
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Williams (O.G.) and Skaggs (R.L.), Las Vegas, NV (USA)
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Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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EG-77-G-01-4040	**George Washington Univ., Washington, DC (USA). School of Engineering and Applied Science**	
	4:8392	TID—28503
EG-77-G-04-4158	**Williams (O.G.) and Skaggs (R.L.), Las Vegas, NV (USA)**	
	4:7785	ALO—4158-1
EG-77-G-05-5488	**Georgia Inst. of Tech., Atlanta (USA). Coll. of Engineering**	
	4:7791	CONF-770953—
EG-77-S-02-4198	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nutrition and Food Science**	
	4:7683	COO—4198-6
EG-78-C-07-1701	**Utah Univ., Salt Lake City (USA). Dept. of Geology and Geophysics**	
	4:7885	IDO—78-1701.a.1.1.3
	4:7886	IDO—78-1701-a.1.1.2
EM-77-C-01-8727	**Midwest Research Inst., Kansas City, MO (USA)**	
	4:7731	HCP/M70065—01/2
	4:7732	HCP/M70065—01/3
EN-77-C-02-4325	**Consolidated Edison Co. of New York, Inc., New York (USA)**	
	4:8000	COO—4325-1
ES-77-A-01-6021	**Naval Research Lab., Washington, DC (USA)**	
	4:8713	NRL-MR—3848
ES-77-C-01-4275	**Avco-Everett Research Lab., Inc., Everett, MA (USA)**	
	4:8711	COO—4275-2
	4:8712	COO—4275-4
ES-77-S-02-4296	**Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering**	
	4:9368	UWFDM—250
ET-74-C-01-9087	**Foster-Miller Associates, Inc., Waltham, MA (USA)**	
	4:7281	FE—9087-1
ET-76-S-03-1811	**University of Southern Colorado, Pueblo (USA)**	
	4:8910	TID—28671
EW-78-C-21-8089	**TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.**	
	4:7283	TID—28539
EX-76-A-29-1037	**National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center**	
	4:7705	DOE/NASA/CR—78172
	4:7706	DOE/NASA/CR—150496
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	4:7708	DOE/NASA/CR—150524
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	4:7722	

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	4:7728	DOE/NASA/CR—150747
	4:7729	DOE/NASA/CR—150770
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	4:7849	DOE/NASA/CR—150513
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	4:7852	DOE/NASA/CR—150573
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	4:7859	DOE/NASA/TM—150514
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EX-76-A-34-1006	**Naval Research Lab., Washington, DC (USA)**	
	4:9322	NRL-MR—3826
EX-76-C-01-2211	**North Dakota Univ., Grand Forks (USA)**	
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EX-76-C-01-2289	**Daedalean Associates, Inc., Woodbine, MD (USA)**	
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EX-76-C-01-2372	**International Business Machines Corp., Huntsville, AL (USA)**	
	4:7748	SOLAR/2015—78/14
EX-76-C-01-2386	**Scattergood School, West Branch, IA (USA)**	
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EX-76-C-01-2396	**Radian Corp., Austin, TX (USA)**	
	4:7745	SOLAR/2002—78/07
EX-76-C-01-2401	**Reedy Creek Utilities Co., Inc., Lake Buena Vista, FL (USA)**	
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EX-76-C-01-2449	**Carnegie-Mellon Univ., Pittsburgh, PA (USA)**	
	4:7183	FE—2449-6
EX-76-C-01-2452	**Exxon Research and Engineering Co., Linden, NJ (USA). Government Research Lab.**	
	4:7910	FE—2452-21
EX-76-C-01-2459	**Boeing Aerospace Co., Seattle, WA (USA)**	
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EX-76-C-01-2461	**Georgetown Univ., Washington, DC (USA)**	
	4:7911	HCP/T2461—08
EX-76-C-01-2473	**Combustion Engineering, Inc., Windsor, CT (USA)**	
	4:8793	TIS—5764
EX-76-C-02-3221	**Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry**	
	4:8663	COO—3221-5
EX-76-C-04-0789	**Sandia Labs., Albuquerque, NM (USA)**	
	4:7737	SAND—78-0842
EX-76-C-29-1037	**Wyle Labs., Huntsville, AL (USA)**	
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EX-76-S-01-2340	**City Coll., New York (USA)**	
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EX-76-S-01-2516	**Lehigh Univ., Bethlehem, PA (USA)**	
	4:7309	FE—2516-6
EX-76-S-01-2539	**Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry**	
	4:7234	FE—2537-6
EY-76-A-29-1037	**IBM Federal Systems Div., Huntsville, AL (USA)**	
	4:7713	DOE/NASA/CR—150559
EY-76-A-1037	**National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center**	
	4:7858	DOE/NASA/TM—78165
EY-76-C-02-0016	**Brookhaven National Lab., Upton, NY (USA)**	
	4:7490	BNL-NUREG—24752
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EY-76-C-02-1545	**Ohio State Univ., Columbus (USA). Dept. of Physics**	
	4:9141	COO—1545-239
EY-76-C-02-2811	**Avco-Everett Research Lab., Everett, MA (USA)**	
	4:8708	COO—2811-1
EY-76-C-02-3000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	4:8840	CONF-781033—3
EY-76-C-02-3045-001	**Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.**	
	4:8598	CONF-770735—4
EY-76-C-02-3045-007	**Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.**	
	4:8071	CONF-780622—67
EY-76-C-02-3045-034	**Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.**	
	4:8081	WARD-NC—3045-2
EY-76-C-02-3064	**Harvard Univ., Cambridge, MA (USA)**	
	4:8841	COO—3064-010
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EY-76-C-02-3073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	4:9323	PPPL—1472
EY-76-C-02-3490	**Rochester Univ., NY (USA)**	
	4:8890	UR—3490-1411
EY-76-C-02-4058	**General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center**	
	4:8458	COO—4058-1
EY-76-C-02-4094	**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**	
	4:7667	COO—4094-9
	4:7669	COO—4094-4
EY-76-C-03-0167-023	**General Atomic Co., San Diego, CA (USA)**	
	4:8276	GA-A—14700
EY-76-C-03-0167-038	**General Atomic Co., San Diego, CA (USA)**	
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EY-76-C-03-0167-053	**General Atomic Co., San Diego, CA (USA)**	
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	4:7481	GA-A—15092
EY-76-C-03-0167-065	**General Atomic Co., San Diego, CA (USA)**	
	4:8275	GA-A—14087
EY-76-C-03-0515	**Stanford Linear Accelerator Center, CA (USA)**	
	4:8820	SLAC-TN—78-2
	4:9057	SLAC—214
EY-76-C-03-0700	**Energy Technology Engineering Center, Canoga Park, CA (USA)**	
	4:8074	ETEC—78-10
EY-76-C-03-0824-001	**Atomics International Div., Canoga Park, CA (USA)**	
	4:8073	ESG-DOE—13239

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EY-76-C-03-0893-031	General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.	
	4:8075	GEFR—00373
EY-76-C-03-1144	Bechtel Corp., San Francisco, CA (USA)	
	4:8080	TID—28758
EY-76-C-03-1213	General Electric Co., Schenectady, NY (USA)	
	4:8546	SAN—1213-02
EY-76-C-03-1219	Jacobs Engineering Co., Pasadena, CA (USA)	
	4:7770	TID—28745
EY-76-C-03-1294	General Electric Co., Schenectady, NY (USA)	
	4:8546	SAN—1213-02
EY-76-C-04-0053	Mound Lab., Miamisburg, OH (USA)	
	4:7535	MLM—2562(OP)
EY-76-C-04-0613	Bendix Corp., Kansas City, MO (USA)	
	4:8783	BDX—613-1948(Rev.)
	4:8784	BDX—613-1952(Rev.)
	4:8785	BDX—613-2060(Rev.)
EY-76-C-04-0789	Sandia Labs., Albuquerque, NM (USA)	
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EY-76-C-04-1013	Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA)	
	4:8858	LF—57
EY-76-C-04-3533	Atomics International Div., Golden, CO (USA). Rocky Flats Plant	
	4:7522	RFP—2757
EY-76-C-05-1067	Triangle Universities Nuclear Lab., Durham, NC (USA)	
	4:9152	ORO—1067-16
EY-76-C-05-5202	Kentucky Univ., Lexington (USA)	
	4:7423	TID—28867
EY-76-C-06-1388	Washington Univ., Seattle (USA). Dept. of Physics	
	4:9000	RLO—1388-371
	4:9165	RLO—1388-378
EY-76-C-06-1830	Battelle Pacific Northwest Labs., Richland, WA (USA)	
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EY-76-C-06-1857	United Nuclear Industries, Inc., Richland, WA (USA)	
	4:8145	UNI—857
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EY-76-C-06-2228	Montana State Univ., Bozeman (USA). Dept. of Animal and Range Sciences	
	4:7272	RLO—2228-T3-4
EY-76-C-07-1540	Allied Chemical Corp., Idaho Falls, ID (USA)	
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	4:7515	TREE—1277
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EY-76-C-08-1183	EG and G, Inc., Goleta, CA (USA)	
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EY-76-C-09-0001	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
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EY-76-C-13-1664	Bendix Field Engineering Corp., Grand Junction, CO (USA)	
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EY-76-S-02-0063	Duquesne Univ., Pittsburgh, PA (USA). Dept. of Chemistry	
	4:7248	TID—28507
EY-76-S-02-1340	Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science	
	4:8445	COO—1340-62
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EY-76-S-02-2245	Massachusetts Inst. of Tech., Cambridge (USA)	
	4:8072	COO—2245-42TR
EY-76-S-02-2272	Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering	
	4:9273	UWFDM—248
EY-76-S-02-2807	Kansas Univ., Lawrence (USA). Dept. of Geology	
	4:8650	COO—2807-14
EY-76-S-02-3085	New England Deaconess Hospital, Boston, MA (USA). Cancer Research Inst.	
	4:8889	COO—3085-63

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EY-76-S-02-3416	**Pennsylvania State Univ., University Park (USA). Dept. of Chemistry**	
	4:8662	COO—3416-8
EY-76-S-02-4041	**Carnegie-Mellon Univ., Pittsburgh, PA (USA)**	
	4:7699	COO—4041-6
EY-76-S-02-4051	**Brown Univ., Providence, RI (USA). Div. of Engineering**	
	4:7900	COO—4051-13
EY-76-S-06-2227-021	**Oregon State Univ., Corvallis (USA). School of Oceanography**	
	4:7906	RLO—2227-T21-3
EY-76-S-07-1601	**Utah Univ., Salt Lake City (USA). Dept. of Geology**	
	4:7888	TID—28723
EY-76-S-09-0854	**Georgia Univ., Athens (USA). Dept. of Chemistry**	
	4:8646	SRO—854-21
	4:8647	SRO—854-22
EY-76-S-09-0893	**Georgia Univ., Athens (USA). Dept. of Chemistry**	
	4:7879	SRO—893-14
EY-77-C-01-0789	**Sandia Labs., Albuquerque, NM (USA)**	
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EY-77-C-03-1110	**Martin Marietta Corp., Denver, CO (USA)**	
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NAS-7-100-954355	**Mobil Tyco Solar Energy Corp., Waltham, MA (USA)**	
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NAS-7-100-954356	**Honeywell Corporate Material Sciences Center, Bloomington, MN (USA)**	
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NAS-7-100-954373	**Crystal Systems, Inc., Salem, MA (USA)**	
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NAS-7-100-954521	**Spire Corp., Bedford, MA (USA)**	
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NAS-7-100-954560	**Aerochem Research Labs., Inc., Princeton, NJ (USA)**	
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NAS-7-100-954654	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center**	
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NAS-7-100-954831	**Optical Coating Lab., Inc., City of Industry, CA (USA). Photoelectronics Div.**	
	4:7676	DOE/JPL/954831—3
NAS-7-100-954868	**RCA Labs., Princeton, NJ (USA)**	
	4:7677	DOE/JPL/954868—2
NAS-7-100-954882	**MB Associates, San Ramon, CA (USA)**	
	4:7678	DOE/JPL/954882—10
NAS-7-100-954898	**Lockheed Missiles and Space Co., Sunnyvale, CA (USA)**	
	4:7679	DOE/JPL/954898—2
NAS-7-100-954977	**Materials Research, Inc., Centerville, UT (USA)**	
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	4:8953	Trans Tech Publications, 16 Bear Skin Neck, Rockport, MA 01966,, $40.00
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CONF-7510187-		(Conference on crop productivity - research imperatives, Harbor Springs, MI, USA, 20-24 Oct 1975)
	4:8382	East Lansing, MI; Michigan State University (1975).
CONF-7604150-		(4. electron beam processing seminar, Long Island, NY, USA, Apr 1976)
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P2	4:8968	New York; American Institute of Aeronautics and Astronautics (1977).
CONF-760749-		(Bell Labs. IWIISC conference, Murray Hill, NJ, USA, 28-30 Jul 1976)
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CONF-7609179-		(VGB conference on power stations, Stuttgart, F.R. Germany, 7-9 Sep 1976)

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CONF-770122-	(Symposium on quantum fluids and solids, Sanibel Island, FL, USA, 24-27 Jan 1977)	
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CONF-770264-	(63. meeting of the Technical Section, C.P.P.A., Montreal, Canada, 1-2 Feb 1977)	
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	4:8481	Technical Association of the Pulp and Paper Industry,, $15.00
CONF-770642-	(3. international conference on ion beam analysis, Washington, DC, USA, 27 Jun-1 Jul 1977)	
	4:8644	New York; North Holland Publishing Company (1978).
CONF-770674-	(Nucleon-nucleon interaction meeting, Vancouver, Canada, 27-30 Jun 1977)	
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CONF-780508-		(3. meeting on the technology of controlled thermonuclear fusion, Santa Fe, NM, USA, 9-11 May 1978)
72	4:9273	*See* UWFDM-248
75	4:9339	*See* BNL-24905
76	4:9368	*See* UWFDM-250
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6	4:8873	*See* CONF-781106-1
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4	4:8233	*See* ANL-Trans-1138
5	4:8232	*See* ANL-Trans-1139
CONF-780572-		(Geothermal seminar, Sacramento, CA, USA, 9-11 May 1978)
2	4:7880	*See* LBL-7048
CONF-780576-		(Symposium on biological markers of neiplasia basic and applied aspects, Leesburg, VA, USA, 22-26 May 1978)
2	4:8889	*See* COO-3085-63
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5	4:8587	*See* UCRL-81159(Rev.1)
CONF-780598-		(Symposium on solar-terrestrial physics, Innstruck, Austria, 29 May-10 Jun 1978)
2	4:8853	*See* COO-1340-64
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70	4:7490	*See* BNL-NUREG-24752
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6	4:7733	*See* LA-UR-78-1575
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5	4:8849	*See* SAND-78-1535C
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1	4:9367	*See* UCRL-81206
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4	4:8229	*See* SAND-78-1273C
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1	4:7541	*See* SAND-78-0191C
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26	4:7698	*See* SAND-78-0919C
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6	4:9369	*See* BNL-24679
8	4:9370	*See* BNL-24917
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7	4:8082	*See* ANL-Trans-1140
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1	4:8915	*See* SAND-78-1237C
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1	4:8925	*See* BNL-24809
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NEDG-23549	4:7965	General Electric Co., San Jose, CA
NP-23387	4:7382	National Academy of Sciences, Washington, DC
23430	4:7275	TIC, $1.00
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6456	4:8772	AT
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6542	4:8882	Dep. NTIS, PC A04/MF A01
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ORNL-tr-4576	4:7512	Dep. NTIS, PC A03/MF A01
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PATENTS-DE-		(German: Deutsches Patentamt, Dienstatelle Berlin, Gitschiner Str. 97-103, 1000 Berlin 61, F.R. Germany, DM 3.- per copy, plus postage)
1,501,618/C/	4:8060	
1,514,292/C/	4:8057	
1,764,112/C/	4:8096	
1,815,916/C/	4:8206	
1,965,682/C/	4:8161	
2,144,087/C/	4:8164	
2,207,011/C/	4:8056	
2,218,360/C/	4:8691	
2,238,886/B/	4:8165	
2,243,402/C/	4:8006	
2,263,143/C/	4:8016	
2,345,408/C/	4:8804	
2,357,893/C/	4:8316	
2,408,952/C/	4:8702	
2,430,765/B/	4:8020	
2,440,010/B/	4:8620	
2,440,143/B/	4:7589	
2,452,490/C/	4:8322	
2,529,802	4:7226	
2,535,475/A/	4:8014	
2,538,192/A/	4:8055	
2,549,423/B/	4:7982	
2,551,595/C/	4:8007	
2,604,178/A/	4:8051	
2,607,188/A/	4:7873	
2,609,571/B/	4:7978	
2,615,220/A/	4:8162	
2,615,475/A/	4:7872	

Report No.	Abstract No.	Availability
2,618,345/B/	4:8166	
2,618,872/A/	4:7509	
2,622,252/A/	4:7871	
2,622,718/A/	4:7870	
2,623,862/A/	4:7869	
2,624,318/A/	4:8507	
2,632,514/C/	4:8561	
2,634,780/A/	4:8323	
2,638,357/B/	4:7750	
2,641,119/A/	4:7864	
2,641,325/A/	4:7865	
2,642,062/A/	4:7213	
2,642,732/A/	4:7863	
2,644,196/A/	4:8054	
2,647,458/A/	4:8013	
2,647,459/A/	4:8012	
2,647,653/A/	4:8100	
2,647,972/A/	4:8053	
2,722,992/A/	4:7868	
2,750,280/A/	4:7925	
PATENTS-FR-	(French: Service d'Edition et de Vente des Publications Officielles, 39 rue de la Convention, Paris 15, France, 2.50 F per copy, plus 1.80 F postage for 1 copy)	
2310315/A/	4:7472	
2,311,262/A/	4:8197	
2,320,258/A/	4:7559	
PATENTS-GB-	(GB: Comptroller-General, The Patent Office (Sale Branch), St. Mary Cray, Orpington, Kent, BR 53rd, UK, 0.25 pounds per copy)	
1,499,100/A/	4:8084	
1,500,436/A/	4:7972	
PATENTS-JP-	(Japanese: Hatsumei-Kyokai (Invention Association), 17 Shiba, Nishikubo-Akefune Cho, Minato-Ku, Tokyo, Japan, $.20 per page, plus postage)	
1977-77,999/A/	4:8114	
1977-79,198/A/	4:8327	
1977-81,497/A/	4:8328	
1977-92,099/A/	4:7997	
1977-100,074/A/	4:8069	
1977-100,076/A/	4:8325	
1977-100,100/A/	4:7513	
1977-101,384/A/	4:7479	
1977-101,391/A/	4:8068	
1977-101,397/A/	4:8200	
1977-101,399/A/	4:7996	
1977-102,996/A/	4:7995	
1977-104,683/A/	4:8182	
1977-104,689/A/	4:8183	
1977-104,691/A/	4:8113	
1977-104,695/A/	4:8184	
1977-106,094/A/	4:8151	
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1977-107,494/A/	4:7994	
1977-107,495/A/	4:7993	
1977-109,095/A/	4:8181	
1977-110,390/A/	4:8019	
1977-110,391/A/	4:8180	
1977-110,392/A/	4:8209	
1977-112,096/A/	4:7992	
1977-112,097/A/	4:8208	
1977-112,098/A/	4:8207	
1977-113,489/A/	4:7989	
1977-113,490/A/	4:8179	
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1977/113,493/A/	4:7991	
1977-113,494/A/	4:8199	
1977-113,495/A/	4:8198	
1977-114,887/A/	4:8178	
1977-115,990/A/	4:8067	
1977-115,991/A/	4:8111	
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1977-127,593/A/	4:8177	
1977-135,992/A/	4:8176	
1977-137,588/A/	4:8110	
1977-137,590/A/	4:8175	
1977-139,897/A/	4:7986	
1977-142199/A/	4:7474	
1977-143-397/A/	4:7985	
1977-148,799/A/	4:8109	

Report No.	Abstract No.	Availability
PATENTS-SE-	(Swedish: Patentverkets bibliotek, Box 5055, S-102, 42 Stockholm 5:, Sweden, Kr 5.- per copy)	
7,501,251-8/B/	4:8195	
PATENTS-SU-	(SU: The abstracts are obtained from Otkrytiya, Izobreteniya, Promyshlennye Obraztye Znaki in which abstracts only are published, Moscow, USSR)	
473,221/A/	4:8185	
PATENTS-US-	(US: Commissioner of Patents, Washington, D.C. 20231, USA, $.50 per copy. Government Patent Applications available from NTIS)	
3,954,539	4:7421	
3,958,762	4:7419	
3,962,881	4:7417	
3,971,637	4:7225	
4,083,924	4:7193	
4,088,998	4:8851	
4,089,666	4:8450	
4,089,667	4:8487	
4,090,838	4:8501	
4,091,320	4:8344	
4,091,614	4:8794	
4,092,130	4:7531	
4,092,540	4:8774	
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4,101,846	4:8718	
4,101,847	4:8719	
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GJO Available from DOE Grand Junction Office, P. O. Box 2567, Grand Junction, Colorado 81501.

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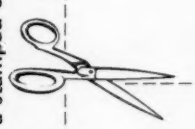

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